Engineering
Library

JUL 17 1934

ELECTRICAL WORLD

LIGHTNING FLASHOVERS . . . ON THE LINE...OR AT THE STATION?

It's all a question of planning, with today's equipment and protective technique.

20 YEARS OF OUTDOOR METERING

Not so new as one might think. On the basis of Detroit Edison's two decades of experience valuable lessons may be learned now.

FOR DEPRECIATION ACCOUNTING

Some see overwhelming advantages in old systems, others prefer newer ways. There is, as usual, much to be said for both viewpoints.

TO LIGHT THE LARGEST BRIDGE

Reliability and accessibility are at a premium on such jobs as this. Flexibility must also be provided for roadway, aviation and navigation lighting.

OPERATING EXPERIENCE LESSENS WITH GROUNDED NEUTRAL

Northern States Power, with several years of operating data behind it, tells what it learned of benefits and difficulties.

JULY 14, 1934

McGraw-Hill
Publishing Company, Inc.

25 cents per copy

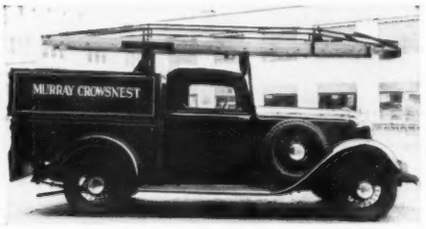
UNIV OF MICHIGAN
GENERAL LIBRARY
ANN ARBOR MICH

PERFORMANCE

MURRAY DEMOUNTABLE CROWSNESTS WORK

Efficiently—Economically—Safely

1 Emergency Line Work
2 Line Inspection
3 Exposition Work
4 Pennant Stringing
5 Servicing & Washing Street Lights
6 Painting and Numbering Transformers
7 Making Service Takeoffs
8 Servicing Traffic Lights
9 Pulling Cutouts
10 Tree Trimming
11 Christmas Decorating
12 Flood Light Display
13 Sign Work
14 Painting Mast Arms and Standards
15 Servicing Fire Alarm Signals



75 POSITIONS

15 APPLICATIONS

METROPOLITAN DEVICE CORPORATION
1250 ATLANTIC AVENUE
BROOKLYN · NEW YORK

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

I'm interested in the Murray Demountable Crowsnest. Send operating and construction details.

Name .....
Title .....
Company .....
Address .....

ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, Editor

E. R. SEARLES, Managing Editor
A. E. KNOWLTON, Associate Editor
EARL WHITEHORNE, Associate Editor
G. F. WITTIG, Statistical Editor
FRANK R. INNES, Western Editor
H. S. KNOWLTON, New England Editor
PAUL WOOTON, Washington Correspondent
JAMES H. RUDD, Manager
C. W. LEIHY, Pacific Coast Editor

Reader's Guide to This Issue

•

Of Executive Interest

Page
Depreciation accounting preferred..... 39
Outdoor metering evaluated..... 41
Grounded neutral distribution succeeds... 47
Arresters check lightning flashovers..... 52
Karl T. Compton sees engineer economists. 54
Present status of air conditioning..... 55

For Power Company Engineers

20 years of outdoor metering..... 41
Pumpless arc rectifiers hold vacuum..... 46
Data on grounded neutral system..... 47
Southern outdoor meter wiring standards. 50
To let air into cable ducts..... 50
Lead grounding affects lightning protection. 50
For better 6,900-volt dead-ends..... 51
Protection from lightning flashovers..... 52

On Power Company Sales

Power uses far from saturation..... 43
Bridge lighting demands ingenuity..... 44
Air-conditioning load analyzed..... 55
Electrical control speeds asphalt mixing.. 56

For Electrical Engineers in Industry

Lighting the George Washington bridge.. 44
Karl T. Compton visions "New Deal" engineer 54
Asphalt mixing speeded electrically..... 56
Electric heat ages gas-filled bulbs..... 57
Wattmeter charts aid pulp grinding..... 57

For Electrical Manufacturers

Cheaper outdoor metering wanted..... 41
Vacuum held by pumpless arc rectifiers.. 46
Lightning arresters check outages..... 52
Air-conditioning opportunities 55

•

THIS INDEX is merely a convenient guide. Many articles will appeal to several reader groups—many will apply to all. News and other departments are of general interest.

CONTENTS . . . . . JULY 14, 1934

For Depreciation Accounting . . . 39
By C. WOODY THOMPSON, State University of Iowa

20 Years of Outdoor Metering . . 41
By O. E. HAUSER, Detroit Edison Company

Problems of Bridge Lighting 44
By FRANCIS A. WESTBROOK, Consulting Engineer

Our Grounded Neutral Experience 47
By D. M. BUNN and M. T. JAMIESON, Northern States Power Company

Solving the Lightning Problem . . 52
By L. V. BEWLEY, General Electric Company

Air Conditioning's Status 55

Electric Power Uses Far from Saturation..... 43
Pumpless Arc Rectifiers Hold Vacuum Successfully..... 46
Outdoor Meters Installed by Southern Standards..... 50
To Let Air Into Cable Ducts..... 50
Ground Lead Impedance Can Spoil Lightning Protection..... 50
For Better 6,900-Volt Dead-Ends..... 51
Karl T. Compton Sees Engineers Economic Specialists..... 54
Electrical Control Speeds Asphalt Mixing Process..... 56
Electric Heat Helps Age Gas-Filled Bulbs..... 57
Wattmeter Charts Show Right Grinder Adjustment..... 57
News of the Week..... 58
Men of the Industry..... 66
New Equipment 67

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

VOLUME 104 . . . NUMBER 2

Contents Copyrighted, 1934, by McGraw-Hill Publishing Company, Inc.

ELECTRICAL WORLD—Published weekly, price 25 cents a copy. Subscription rates—United States, Mexico and Central and South American countries $5 a year. Canada, including duty, $7.50 a year. All other countries, $9, or 36 shillings, a year. Entered as second-class matter January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C.

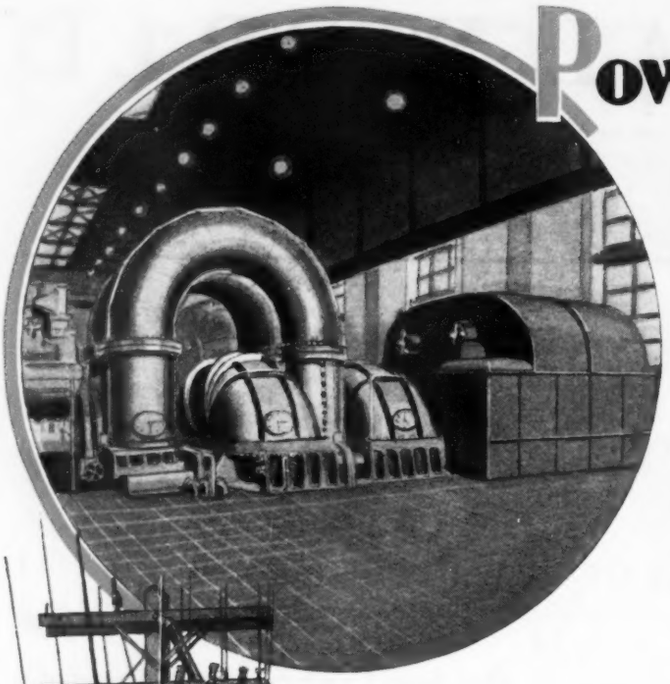
Printed by The Schweinler Press, N. Y.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 West 42d Street, New York, N. Y.

NRA CODE GRAPHIC ARTS INDUSTRY 1934 REGISTRATION NO. 3H568

JAMES H. McGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. McGRAW, JR., Vice-Pres. and Treas.
MASON BRITTON, Vice-President
HAROLD W. McGRAW, Vice-President
H. C. PARMELEE, Vice-President
B. R. PUTNAM, Secretary

Cable address: MCGRAWHILL, New York. Member A.B.P. Member A.B.C.



Power-Plant Planning Goes Into the Distribution System « « «

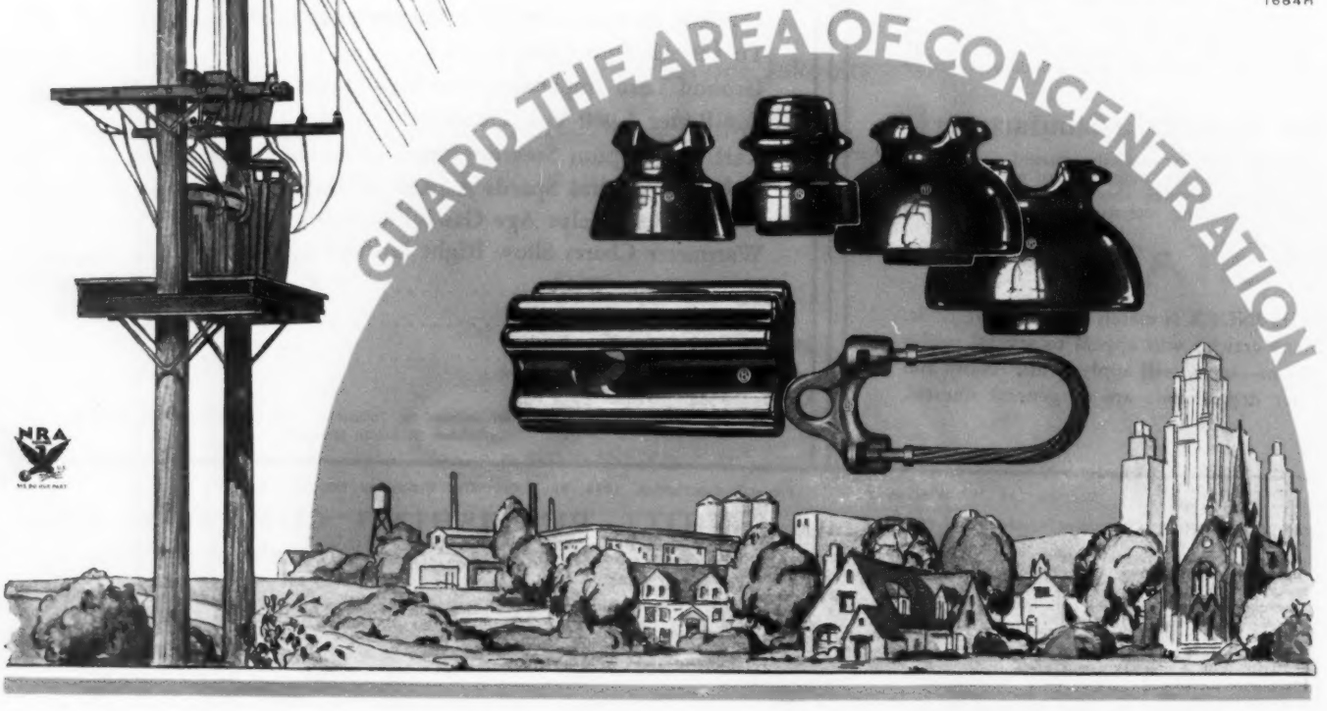
THE same thorough planning with which the largest and most important power stations are built, is now marking programs of distribution rehabilitation and extension. And rightfully so, because the distribution system is the area in which operating, service, and investment values are concentrated. In guarding this area of concentration against service interruptions and loss of customer good will, added assurance is given to the successful achievement of your purpose when the materials used in the program have the mark of dependability. O-B has numerous distribution necessities, all earmarked with the same service assurance which characterizes O-B products for the most exacting high-voltage service. Why not turn to this assurance which O-B products can give to your planning? They cost no more; they actually cost less when viewed from the standpoint of long life and freedom from trouble.

OHIO BRASS COMPANY

Mansfield, Ohio, U. S. A.
Canadian Ohio Brass Co. Limited — Niagara Falls, Ontario, Canada

New York · Philadelphia · Boston · Pittsburgh · Chicago · Cleveland
Atlanta · Dallas · Los Angeles · San Francisco · Seattle

1684H



ELECTRICAL WORLD

Established 1874—McGraw-Hill Publishing Company, Inc.

for the Week Ending

July 14, 1934

L. W. W. MORROW, *Editor*

The Rash Bet of T.V.A.

The Tennessee Valley Authority went back to Congress and obtained another $50,000,000 to continue its work. It is going to start four more dams, chiefly upon the plea that this will bring unemployment relief. Testimony of Dr. Morgan showed a balance sheet for the Tennessee about like this: Already paid on Muscle Shoals as a project, $100,000,000; expended and to be spent immediately on six dams, $198,000,000, including Norris and Wheeler dams. Assuming Muscle Shoals is worth $30,000,000 for power purposes and that 30 per cent of the cost of the new dams will be charged to navigation, the total power value for the completion of this stage of the project will be $169,000,000. This sum will make available 750,000 kw. of primary power and 1,000,000 kw. of secondary power. The unit price is about $225 per kilowatt of primary power.

For the twelve months ended in June of this year the power sales of the T.V.A. amounted to $793,603 and the estimate of income for the coming year is $1,250,000. These gross revenues of the present day are expected to be expanded to afford the revenues to carry the contemplated $169,000,000 project and pay for all operating expenditures. Any one familiar with the conditions in the markets where the power is to be sold can realize that a long, long trail of deficits must be faced before this can be done, if at all.

To fix a theoretical price for energy based upon an almost impossible ultimate development of volume sales is a rash bet that only a governmental agency using the money of taxpayers would dare take. But who stands to lose?

What About the Housing Bill?

It is rather astonishing to find the administration doing the sales promotion job for the electrical industry. It consistently preaches the gospel of "do it electrically" and it has acted in many ways to carry the gospel into practice. To the T.V.A. and E.H.F.A. is now added the home modernization and repair program, backed by $200,000,000. Any home owner who will modernize can take advantage of the loans up to $2,000. Improvements must be fixed to the property. Terms are from three to five years on a monthly installment basis. The home owner can borrow up to one-fourth his annual income on his personal note.

Rewiring, built-in air conditioning, a built-in electric kitchen and many other modernization improvements are opened to the electrical industry. The administration has gone so far as to request a cut in prices and in wages for this work. The home electrical idea now has government aid and backing. Why not organize to do a selling job?

Let Advertising Do Its Job

Now that power company executives are turning to market development as the logical answer to their problem, it is time they gave some thought to advertising. For advertising has been too long neglected and abused by many public utilities and much of its great power for selling has been thrown away.

Power company advertising has suffered largely from an obsession for dignity. And the

reason is that it has been written to please the boss rather than to speak to the people, which, after all, is its only mission. Too often it has represented the sales manager's or the vice-president's idea of how to explain the company's policy, instead of talking the living language of the men and women of the town and telling them something that they will be glad to hear. There is a deal of difference.

Selling now becomes the chief objective in the electric light and power business. Advertising is the most effective influence for selling anything that must be presented to the entire public. Advertising must be recognized as a major responsibility in utility management. The time has come to call a halt on amateurish efforts and to get down to the serious purpose.

For advertising has a technique. It is an art. It cannot be intrusted to untrained hands and minds any more than a substation or the load dispatcher's office. Advertising is the company speaking to every customer and every voter. That alone makes it important. But even more vital, it is the approach to sales. It opens the door to larger earnings. It should be executed with the greatest possible skill, not to suit the personal preferences of the president, but to appeal to the public and make it want to use more electric service.

Air Conditioning—An Opportunity

Drop into a house, a business office, a theater or a restaurant that has an air conditioner and note the reaction these hot days. What a comfort! I must have this! What does it cost? Where can I buy one? Air conditioning sells itself because of the service it renders. Rather expensive, not completely perfect and still developing in its details, the fact remains that air-conditioning equipment is here and is ready for a very receptive market. It is the best possible device to sell during the summer doldrums and the electrical industry should be hard after this business.

Try the unit coolers out in the offices of business men. The universal answer to the service is that it is worth many times what it costs, and these prospects in the office become good prospects in their homes. It is more agreeable to sleep in comfort than it is to work in comfort. The small stores and neighborhood theaters will buy air conditioners and there is a large strata of home owners able and willing to pay for unit conditioners. A demonstration of air conditioning is the most convincing sales weapon—anyone who has lived a few days in an air-conditioned room will not return to the sweltering discomfort of midsummer. Sell others air conditioners and, incidentally, sell yourself by trying one out in your office and in your home. The business is made to order for summer sales.

Electric Heating at Industrial Focal Points

As applications of industrial electric heating multiply emphasis is increased on concentrated service at manufacturing focal points. These points may be so numerous as to develop areas and finally volumes of useful work, but the principle is the same whether the industrialist is heating a tiny wire or a chamber through which material in process passes under the required temperature conditions. Control may be had within a very few degrees even when high temperatures are necessary, and the percentage accuracy of regulation may actually increase in these upper brackets. The ability to focus electric heat where it is most needed is a primary advantage of this service and comparative costs on a B.t.u. basis are frequently of little importance on account of quality requirements.

In a typical case copper tubes had been annealed by gas flame with irregular results. Uniform heating, speedily applied at certain places in the tube length, was requisite. Low-voltage, high-current energy passed through the tube solved the problem, and the intense heating was confined to the future bend sections by providing the tubes with thin lugs or heat-dissipating metal sheets on each side of the focal area where bending would be necessary. By the provision of sufficient metal mass to carry off heat from areas where it was not needed and leaving the tube proper exposed to the full heating effect of the traversing current at the working section this portion only of the tube became red hot in a few seconds and annealing was then effected with ease and uniformity. The cost of the heat wasted from the lugs was of little importance compared with the quality treatment repeatedly assured through concentrated application of energy. The compactness of electric heat applications fits them for valuable service in innumerable special manufacturing set-ups.

Depreciation Accounting Favored

A Reply to the Pro-Retirement Plea of E. P. Coleman in our May 19 Issue

By
C. WOODY THOMPSON
State University of Iowa

Whether to use retirement or depreciation accounting continues a live and important subject confronting utilities and regulatory bodies. Mr. Thompson outlines the arguments for one school of thought and challenges the contentions of those who advocate retirement accounting.

IN HIS argument for retirement accounting as superior to depreciation accounting E. P. Coleman, investment analyst for the National Life Insurance Company, goes out of his way to label his opponents as "economists who are able writers, but absolutely without practical operating experience."* If he hoped by this process to silence his opponents he is wrong. Were I inclined to pay compliments to his side of the controversy I should ask what an investment analyst knows about the "practical operations" of a public utility? Whatever else may be said about the economist, no one can accuse him of being a partisan (in disguise) for a special interest. Further, I am sure that the members of the Wisconsin Public Service Commission and the Interstate Commerce Commission, not to mention the officials of the American Telephone & Telegraph Company, all advocates of depreciation accounting by straight-line or sinking fund methods, will be amazed to find themselves classified as ones "without practical operating experience."

The problem, then, of how best to care for the admitted fact of depreciation is not so one sided as some of the proponents of retirement accounting would imply. There are valid practical arguments for the other side. This defense can do no more than open the problem. One who is interested in following up this subject should read the booklet of the Wisconsin Public Service Commission entitled *Depreciation* and the orders of the Interstate Commerce Commission on railroad and telephone depreciation, 118 I.C.C. 301 (1926) and 177 I.C.C. 351 (1931).

The only scientific approach to depreciation is through its proper definition and understanding. Practically all experts define it as a loss of service life, such loss the result of use, time, the elements, obsolescence, inadequacy and social forces. Regardless of the causes of depreciation, it is one of the real and significant costs of operation. Turbines contribute to the production of electricity as surely as do coal and labor. No one doubts that the coal and wage bills are costs, yet the retirement expense advocates would have us postpone indefinitely the depreciation costs on the turbine. Every hour the turbine turns, *or stands,* it moves one hour nearer its inevitable retirement from service. To quote a classic phrase, "All machinery is on an irresistible march to the junk heap, and its progress, while it may be delayed, cannot be prevented by repairs."† Every hour a machine is used or stands costs to the owner are incurred. From this analysis, therefore, it follows as an unchallenged conclusion that depreciation—a vital cost of production—should be accounted for as it occurs. Which method of reckoning, depreciation accounting or retirement expense and reserve accounting, better accomplishes this objective? There can be doubt that it is the former.

One further fundamental of depreciation must be understood. The primary purpose of its recognition and calculation is to conserve and keep intact the investment. This is but a corollary of the cost nature of depreciation. All emphasis on replacement is fallacious, for, as will be shown below, we may never replace. Under this emphasis there need be no allowance for depreciation. When the conservation of the investment becomes the foremost purpose of depreciation the calculation of depreciation and the recovery of depreciation loss must be made during the life of the depreciating asset. Any recognition which postpones until the time of retirement and replacements defeats this fundamental purpose—and fails to keep intact the investment.

The advocates of retirement expense and reserve usually attack depreciation accounting by charging it to be based on estimates and tables of expected life, none of which is accurate. This is a weak charge because retirement *reserves* are also estimates. In so far as management sets up a reserve, it is far better to be guided by estimates based on the life expectancy of assets, though they may be only estimates, than to rely upon the caprice of management. If management relies upon its own judgment in fixing its credits to retirement reserves it is guided by nothing but caprice. Further, if

*"*Retirement vs. Depreciation Accounting,*" ELECTRICAL WORLD, page 715, May 19, 1934.*

†*Hatfield, Accounting, page 130.*

the errors in the estimation of service life of machines and other tangibles discredit depreciation accounting, then many other businesses and business methods are discredited. All insurance is based upon estimates. The recent Chicago stockyards fire could not have been precisely predicted by the fire insurance companies writing policies there. I suppose that their methods are faulty and should be replaced by management (caprice) estimates.

In any event, critics like Mr. Coleman cannot overlook the opinions of such advocates of depreciation accounting as members of the Interstate Commerce Commission and officials of the Bell System. These experts insist that, *for all practical purposes,* depreciation accounting is workable and preferable. They have proved that the errors in estimates are too slight to be of material importance.

Retirement expense and reserve accounting is inferior to straight-line and sinking fund methods of accounting for depreciation for the following reasons:

1. It is capricious—see above comments.
2. It violates the basic fact that depreciation is a cost of operation. To meet the cost of replacement out of the operating income of the period of retirement loads that period with costs not properly assignable to that period.
3. It is claimed that in reality retirements become so continuous that the retirement charge is about the same and as regular as a depreciation charge would have been. As a matter of fact, there is no rhythm in replacements. If there were the claims under item 6 would be invalidated. In the second place, if these claims were valid, then all savings to customers in the form of lower rates arising out of retirement accounting disappear.
4. The use of this method of accounting fails to consider the problem of retirements not to be replaced. If no replacement is made, then no charge is made and the retired asset continues to appear on the books of the company. This overstates the asset values and results in a reduction of the stockholders' equities. If a reserve has been created for this contingency, it was based on some type of estimate or else governed by sheer caprice. Thus, the use of a retirement reserve admits the theory of proper depreciation accounting.
5. Retirement accounting assumes that the utility is a going concern and never as a whole is retired from service. Since a going concern functions indefinitely at a given rate of efficiency it is unnecessary to recognize depreciation by means of depreciation accounting methods. Depreciation and engineering efficiency are not the same thing, and whoever confuses them shows his ignorance of the true nature of depreciation. The individual units in a productive process lose service life, and this loss is a valid cost which only depreciation accounting recognizes.
6. One claim of Mr. Coleman's school is that their theory maintains the credit standing of the utility. When earnings fall the retirements may be reduced and credits to the retirement reserve curtailed, thereby leaving a larger balance called "net profit." Why not set up part of the wage and coal costs as deferred debits (assets) and thus make the "net profits" even larger? All costs, including depreciation, should be accounted for when they are incurred. Thus, no one is fooled and the long run credit position is materially strengthened.
7. Retirement accounting impairs the equities of the stockholders. In the early years of a plant there is little or no replacement. Even using a reserve of a capricious amount only partially covers the loss. If it does more, it is a disguised form of depreciation accounting. During these years rates need not cover retirements, but during these same years there has been a material loss in the plant service life which the finest of maintenance cannot erase. This loss has not, and never will under retirement accounting, be recovered. No amount of figuring—assuming vigilant state regulation—will explain away this fact. For myself, I would rather invest in a business which uses depreciation accounting because this better protects my equities.
8. Retirement expense accounting confuses the prime purpose of depreciation charges and credits—that of maintaining intact the investment. Had street railway companies realized this less of the investment of stockholders would have been lost. As an industry such as this one approached maturity and eventual obsolescence (in towns under 50,000) proper depreciation accounting would have made it possible to salvage some of the investment. Reserves built up in better days and kept on current, liquid assets could have been distributed to owners. As it was, no such funds existed. When the decline came, after 1920, fortunate was the company whose revenues covered direct operating costs. When retirements were made it was an impossibility to charge them against earnings—there were no earnings! Thus, retirement expense assumes an indefinite social need for a given utility, a dangerous and fallacious assumption.

Authorities support depreciation accounting

HOWEVER one views this problem of depreciation, he inevitably comes to the conclusion that it is best handled by what is dubbed the depreciation accounting theory. Some form of straight-line or sinking fund method based on the estimated service life accomplishes this end. At least so thinks the most progressive state commission—Wisconsin—the Interstate Commerce Commission and the American Telephone & Telegraph Company. Such a group of defendants proves that the equities are not all on the side of the retirement advocates.

How, therefore, can one account for the tenacity of the advocates of this weaker theory? Some support it because of their confused notion of what is depreciation. They confuse it with efficiency, they fail to recognize it as a cost, they fail to see that depreciation has nothing to do with replacement. Others are misled by the apparent difficulties in making a practical application of straight-line and sinking fund calculations. The constant unsupported reiteration of this point by the opposition seems to have borne fruit.

There is another explanation of the strength of the supporters of retirement accounting which has not often been mentioned, but which is the best explanation of all. Depreciation has only been recently recognized. Its late recognition, however, did not create the fact of depreciation. Thus, in the early years of railroad and utility financial and accounting practices, it was disregarded. With the coming of stronger regulation after 1907 came valuations. Then, much to the dismay of the utilities, they found their asset values being reduced by depreciation estimates. This practice reduced net values and justified lowered rates. Had they made proper depreciation calculations in the past, this practice of the state commissions would not have bothered them.

To meet this situation, two options were at hand—either claim that the plant was undepreciated or else construct a new depreciation theory that was less severe in its effects. Surprising as it may seem to an outsider, the first type of defense is still used. In a recent hearing, one expert for a utility testified that in his opinion a certain water company was only 2 per cent depreciated! There could be no better illustration of the efficiency theory of depreciation. The second option has been the better choice. For a fully grown plant depreciation might be as much as 40 to 50 per cent of the total ledger asset values. By insisting on a combination of retirement expense and retirement reserve theories, this figure could be reduced to 15 to 20 per cent. Thus, retirement accounting justifies higher calculations and, as a consequence, higher rates. It works admirably to cover over the failure in former years to recognize by any method of accounting the fact of depreciation.

One thing is sure. If the utilities are permitted to use retirement expense in order to sustain valuations, there should be careful check of its use, because from an

operating expense viewpoint, during the early and expanding years, this retirement charge should be less than charges made according to depreciation accounting. Rates should be so adjusted. Too often a utility will charge depreciation by one method and set up reserves by another, thus straddling theory to gain double profit.

As a matter of practice, most public utility economists, those persons who are accused of lacking practical operating experience, do not object to retirement expense accounting for small and frequently replaced items of property. They concede that some bookkeeping effort may thereby be saved. They know that this accomplishes results similar to that flowing out of depreciation accounting. For larger and less frequently replaced items of property, however, neither retirement expense nor retirement reserve accounting should be used. Good, conservative management should use one of the methods related to depreciation accounting. Thereby the long-run interests of the public, the company and the stockholders are best conserved.

---

20 Years of Outdoor Metering

By
O. E. HAUSER
Engineer Meter Department,
Detroit Edison Company

An experience of twenty years determines the practices now followed in installing new, and relocating old, meters on the Detroit Edison system where conditions make outdoor installations desirable. But the continuation and extension of the outdoor meter program may wait upon a more comprehensive and less costly scheme of outdoor installation than is now available. There is a lesson here for every utility man with direct customer-contacts.

THERE are now about 40,000 outdoor meter installations in the Detroit Edison territory, approximately 8 per cent of the meters in service. Forty per cent of the outdoor installations are of the modern type, of which 15,000, or 37 per cent, were due to a rebuilding program, which will be described later. In this program very little trouble has been experienced. There arise a few cases where the customer objects to the outdoor installation of the meter. These cases are handled by the sales department and an agreement reached either for an outdoor or modern indoor installation. To what extent the rebuilding program will be continued is uncertain, and will be uncertain until an outdoor metering scheme is developed which will permit the use of the various types of modern meters and which will cost appreciably less than the present set-up.

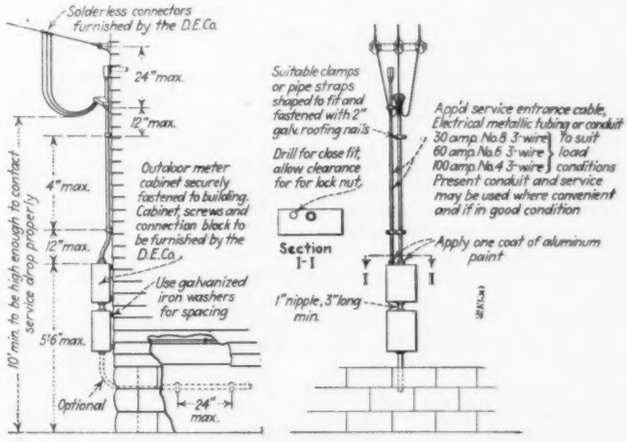
How it all started

Consideration was first given to outdoor metering by the company approximately twenty years ago when the distribution lines were extended to take in outlying territory which included summer resort properties. The summer resort properties presented a problem in metering for the reason that the premises were occupied seasonally, and in many cases irregularly during the season. Consequently a main consideration given to metering for this class of customer was meter location. It followed that the only location which would be accessible at all times would be outdoors.

In those days there were no metal meter inclosures, or, strictly, outdoor meters as we know them today. Furthermore, the advantages to be derived from installing the meter ahead of the service switch had not been thought of seriously. Therefore the meter and switch were installed in a wooden box with its door hinged on the side and fitted with a hasp for a padlock. Various wooden box specifications were necessary to accommodate various sizes of switches, and since the customer furnished and installed the box, trouble was always experienced in getting a box suitable to both parties concerned.

About ten years ago various box manufacturers developed a line of steel outdoor meter boxes with exter-

(Please turn to page 43)


Solderless connectors furnished by the D.E.Co.
24" max.
12" max.
4" max.
12" max.
5'6" max.
10' min. to be high enough to contact service drop properly
Outdoor meter cabinet securely fastened to building. Cabinet, screws and connection block to be furnished by the D.E.Co.
Use galvanized iron washers for spacing
Optional
24" max.
Suitable clamps or pipe straps shaped to fit and fastened with 2" galv. roofing nails
Drill for close fit, allow clearance for for lock nut
Section I-I
1" nipple, 3" long min.
Appd service entrance cable, Electrical metallic tubing or conduit
30 amp. No. 8 3-wire
60 amp. No. 6 3-wire
100 amp. No. 4 3-wire
To suit local conditions
Present conduit and service may be used where convenient and if in good condition
Apply one coat of aluminum paint

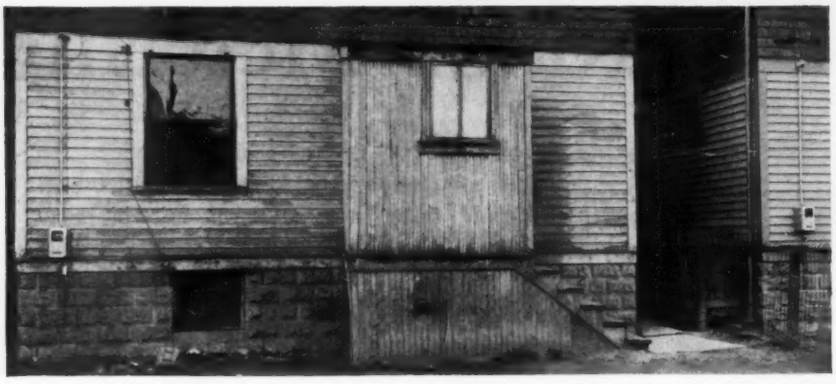
Contractors work from these drawings

This is C.S.D. 915 referred to in the specifications under which contractors wire for outdoor meters. These drawings are typical, not definite for a particular job. They show two boxes when several or only one might be required and lead-in conduits up and down when both or only one might come from either bottom or top.

For two-family flats

The views here and opposite show how the same fundamental scheme is used for a variety of residential installations.

On single residences



Policies and Specifications Now Followed in Detroit

1. *General*—The outdoor meter cabinet is being installed to decrease the inconvenience to the customer resulting from meter readers and testers entering the building, etc.

The installation will be made according to these specifications and as outlined on drawing C.S.D. 915. (See illustration.)

2. *Location*—The Detroit Edison inspector will determine the location of the meter box.

3. *Service and Load Wires*—The new equipment will be installed so that it will not necessitate a change in the service wires or service bracket unless this change is approved by the inspector.

4. *Present Equipment*—Wherever the existing equipment is in good shape and where anticipated increases in load do not prevent, the existing equipment may be used. The existing service conduit may be used in its entirety if the meter cabinet can be properly installed in the conduit run. Where the existing service conduit cannot be used, approved armored conductor, heavy wall conduit or electrical metallic tubing may be installed and may duplicate existing service conduit and wire in size. The use of electrical metallic tubing is recommended.

5. *Interruption of Service*—All work in connection with rebuilding services shall be carried on so as to minimize the interruption to the customer's service. The customer should be notified of the approximate time of the interruption prior to beginning work.

6. *Extent of Work*—Unless a meter installer accompanies the electrician from house to house the contractor will reestablish service by closing the loops in the outdoor meter cabinet and at the old meter location. He will remove the meter and place it in the outdoor cabinet, but will not connect it. All excess equipment, etc., at the old meter location shall be removed so as to give a neat appearance.

7. *Damage*—The contractor shall hold the Detroit Edison Company free from loss due to damage to customer's property. He will do his work with minimum alteration to the building and will plug all holes. The drilling of holes into the building for recessing the feet of the box is prohibited. He will rectify all complaints in a reasonable length of time.

8. *Certificate of Inspection*—The contractor will furnish the D.E. Co. with a certificate of inspection covering the work in question from the municipality having jurisdiction on completion of said work; this certificate of inspection must accompany the invoice.

9. *Workmanship*—All work must be done in a neat and workmanlike manner. The contractor will see that the customer's premises are left in a clean and orderly condition.

10. *Materials*—All materials and fittings used must be waterproof and rust-proof and shall be installed so as to prevent water from entering the meter box or conduit. All mounting screws shall be galvanized.

11. *Mounting*—The meter box shall be plumb and shall be fastened with galvanized screws or bolts; cadmium material will not be permitted. The boxes shall be mounted so as to provide a free air space between the box and the building. On a single box installation four screws shall be used per box. On a multiple box installation two screws per box may be used. The box shall not be twisted or distorted by mounting screws, conduit or other devices.

On brick or stone buildings Peirce, Chicago, or similar inserts will be used to fasten the box. The inserts shall be placed in the brick or stone, not in the mortar. Where the course in the brick or stone prevents the placing of the insert properly, two inserts per box instead of four will be permitted, provided two two-hole straps are used with inserts, one around the conduit immediately above and the other around the conduit where used immediately below the box.

On wood buildings No. 12 round head galvanized iron wood screws 1 in. or 1½ in. long shall be used. Where wood screws do not provide sufficient support galvanized screws and toggles shall be used. The drilling of holes in the back of the meter box for the installation of additional wood screws is prohibited.

On tile or stucco buildings ¼-in. galvanized iron screws shall be used with toggles or inserts.

On installations requiring two boxes these boxes will be mounted where possible in a vertical line and connected together with a 1-in. nipple not less than 3 in. long. On installations requiring more than four meters a special weatherproof box will be furnished.

12. *Salvage Material*—Salvage material will be painted with aluminum paint if used on any other installations coming under these specifications.

13. *Arrangement of boxes*—Wherever possible, boxes will be arranged to indicate the part of the building served. Where no natural relation exists, the upper meter will indicate the right (viewed from rear) or front portion of the building.

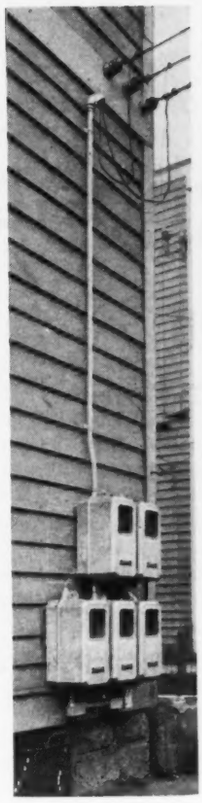
14. *Pipe Bushings*—Pipe bushings shall be galvanized. At least four threads of the bushing shall engage with the threads in the box.

15. *Holes and Knockouts*—All holes drilled into the box shall not be larger than necessary to provide a close fit for the fittings used. All such fittings shall be given one coat of aluminum paint.

16. *Paint*—Oil vehicle aluminum paint shall be used.

17. *Electrical Metallic Tubing*—The electrical metallic tubing used shall be thinwall or similar.

18. *Fuses and Shutters*—The contractor shall replace all fuses not of the proper size and shall install blank end wall plates where necessary. Fuses and plates will be furnished by the Detroit Edison Company.



Multiple installation

Another type of modern inclosure

Detroit Edison has not standardized on any particular box, requiring only that those used conform to its specifications for outdoor installation and make a good appearing job.

nally operated service switches. The steel inclosure was an improvement over the wooden in that it was more durable and smaller. Like the wooden inclosure, it contained the service entrance switch and fuses, which inconvenienced the customer whenever he had occasion to use the switch or replace a fuse.

During the early development of outdoor metering as outlined in the foregoing little, if any, consideration was given to a general program. There were several reasons for this: (1) The National Electrical Code would not permit the installation of the meter ahead of the service switch, (2) the meters were not designed for general outdoor use, (3) periodical testing, then as now, presented a problem in this climate.

About eight years ago the meter manufacturers, in co-operation with the then existing national meter committee, developed the modern meter with its better light and heavy-load accuracy and temperature compensation. Temperature compensation eliminated one of the objections to the outdoor program. During the past few years the National Electrical Code has been changed so as to permit the meter to be installed ahead of the service switch and fuses.

With these two important changes and other considerations, the outdoor meter installation program rapidly came to the fore, so that today it is receiving major consideration. In our case, before adopting a particular scheme of outdoor metering, consideration was given to the various factors in the problem as follows:

1. It is necessary, as a preliminary to any proposal concerning the type of outdoor metering scheme to be adopted, that any modern meter now in stock, or hereafter obtained, may be installed at any location without definitely specifying the type of installation.
2. It is the policy of the company that periodical testing of meters shall be done on the customer's premises without disturbing the meter or connections.
3. Service to customers shall not be interrupted either for meter testing or meter replacement.
4. Only the actual installation of the meter to be done by company employees. All wiring and installing of the outdoor equipment to be done by the electrical contractor. It therefore is necessary that the outdoor equipment have some permanently fixed device to which the contractor can make all wiring connections readily and with which any one of the various types of modern watt-hour meters can be used.

It appeared to us that the inclosure with a fixed connection block and so designed as to accommodate any of the modern makes of meters satisfied these requirements. Accordingly that type of outdoor metering scheme was selected.

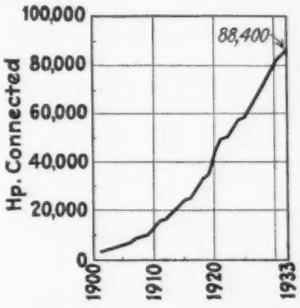
Climatic conditions in the territory served by the Detroit Edison Company are such that meter maintenance on outdoor installations is very inconvenient or impossible during certain seasons of the year. For this reason, it is our practice to identify each outdoor installation in the office records and to schedule periodic maintenance during the season of the year suitable for this work.

The rebuilding program

At the present time the company is rebuilding several thousand older types of service entrances for outdoor installation of meters and specifying that type of installation for certain new residential services and all seasonally occupied properties. For general use, the outdoor cabinet is supplied to the contractor or customer on application at any one of the several offices. The applicant signs a receipt giving the location at which the cabinet is to be used.

The program is being carried out on a contracted price per installation with several electrical contractors. The contractors are assigned sections selected in advance by the company and carry out the work in accordance with the general specifications which accompany this article.

Electric Power Uses Far From Saturation



Growth of motor load
Hartford Electric Light Company

Refuting the belief, frequently expressed, that electric power business as distinguished from industrial electric heating applications long ago reached the flat region of the development curve, the accompanying diagram of the growth of connected motor load on the system of the Hartford Electric Light Company shows a steady gain even during the recent so-called depression years. From 3,200 hp. in electric motors connected on the system in 1900 the service increased to nearly 20,000 hp. connected at the outbreak of the World War, doubled to 40,000 hp. the year after the war ended and reached the surprising total of 76,000 hp. in 1929, rising to 88,400 hp. at the close of 1933.

Reliability, Accessibility in Bridge Lighting

Roadway, Aviation and Navigation Lighting Calls for Appropriate Selection of Cabled Conductors and Ingenuity in Attaching Them

PROVISION of proper lighting facilities for a large bridge over a busy waterway, such as the George Washington Bridge over the Hudson River at New York City, involves a good many ingenious practices which are quite likely to be applicable in some details to other work. There are three different kinds of lighting for as many specific purposes. There is the usual roadway lighting, the aviation lighting for outlining the main suspension cables as a warning to fliers and the navigation lighting on the piers of the bridge towers, under the roadway at each side of the channel and also at the center of the bridge. Particular kinds of cables have been used for these purposes.

Power is brought from both the New York and New Jersey ends of the bridge and each feed is carried all the way across (Fig. 1). Alternate roadway lights are fed from each of these power sources so that the bridge will not be dark if one of the circuits should fail. The voltage is 4,160 and transformers are located at each tower with 220-volt circuits feeding in each direction. At the New York end it is necessary to step up the supply from 208 volts to the 4,160 volts for the feeder to the transformers at the towers. The lights are connected in multiple on a three-wire circuit. The wires used for feeding the roadway lights are also used for the supply of energy along the roadway continuously throughout the 24 hours for illuminating signs, portable tools, etc. The wire is connected to a plug receptacle in the base of each lamp standard which is continuously energized, while the lamp on the same standard is fed through a small relay separately controlled and energized during the daytime. Relays are connected in parallel across a 110-volt circuit, No. 12 wire, extending the length of the bridge.

All power and distribution circuits are in conduits supported under the bridge. On the south side there are two power circuits, two distribution circuits and two spare conduits. On the north side of the bridge there are two distribution circuits.

Flexibility of bridge met in electrical layout

The bridge is extremely flexible. Every 60 ft. there is a $\frac{3}{4}$-in. contraction joint to permit deflection of the roadway under moving loads. From the roadway members, which move with respect to each other, are swung the conduits in continuous rigid lengths of about 400 ft. between splicing chambers. This rigid conduit construction is to assure freedom from relative movement between the conduit and its cable, with consequent abra-

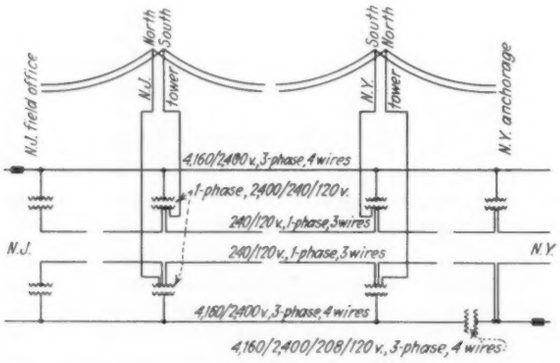
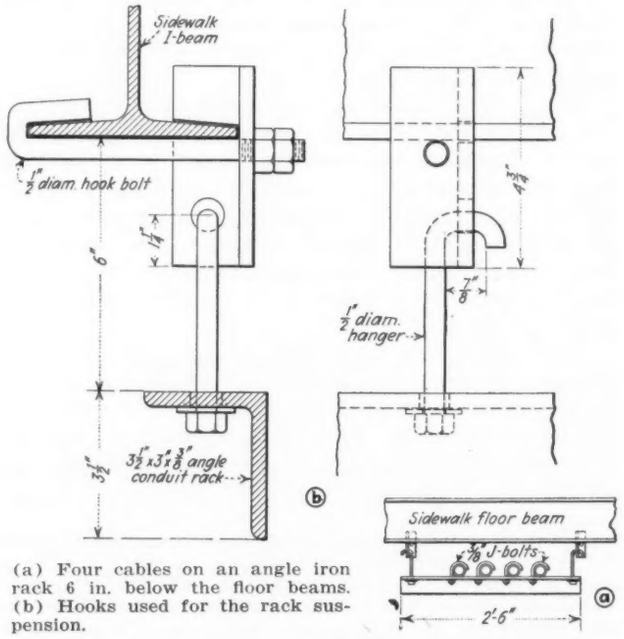


Fig. 1—George Washington Bridge has duplicated 4,160-volt lighting services at the two ends



(a) Four cables on an angle iron rack 6 in. below the floor beams. (b) Hooks used for the rack suspension.

Fig. 2—Feed cables are hung from the underside of the sidewalk floor beams

By FRANCIS A. WESTBROOK
Consulting Engineer,
Center Conway, N. H.

The lighting of the George Washington Bridge presents many problems. Heavy trunk line traffic demands dual service for continuous lighting. Expansions and contractions are large and loops must be provided in the electrical cables. Maintenance requires accessibility for aviation lights above and navigation lights below. Here's the way it was worked out.

sion of the cable sheath. Because of the rigid conduit construction and the movable bridge members it was necessary to provide for relative movement between conduit ends entering opposite sides of the splicing chambers. In addition to the contraction joints mentioned there are expansion joints on each side of each tower to allow for temperature variation and for drift of the roadway as a whole with the wind. The design provided for a relative movement between opposite sides of this joint of as much as 5 ft. under extreme conditions.

While lead is extremely desirable for protecting rubber insulation, trouble has been experienced with sheaths due to rapid vibrations, such as might be expected on a bridge, and the conditions at the expansion joints made it imperative to abandon lead as a protection for the cables.

The 4,160-volt cable consists of four No. 4 A.W.G. stranded conductors, each covered with 10/64 in. of 30 per cent rubber insulation having a serving of rubber-filled tape, the tape being marked so that the conductors may be identified. Conductors are cabled together with jute fillers impregnated with asphaltic base compound and the whole is covered with a wrapping of rubber-filled tape. This is covered with asphaltic compound and given a serving of heavy jute yarn, the whole being covered with a hemp braid, both thoroughly impregnated with compound, and given a coating of wax and mica to facilitate pulling into the conduits. The low-voltage cable for distributing to the lighting standards has three conductors and is made up similarly to the high-voltage cables, except that the thickness of insulation is that proper for 600-volt service and instead of having an outer jute wrapping and hemp braid there is an impregnated double cotton braid.

Conduits are clamped to crosspieces of angle iron by means of curved bolts and the crosspieces are supported by hooks so that the whole may move back and forth with the expansion and contraction of the bridge due to changes in temperature and load. The method of suspending this from the bottom of the sidewalk I-beams is also shown in Fig. 2. The conduits terminate in splicing chambers about every 400 ft.; the arrangement of these is shown in Fig. 3. It will be seen that arrangements have been made so that the cables will bend with the expansion and contraction of the bridge. An interesting additional detail is shown in Fig. 4; it consists of a bushing which acts as a protective cushion and prevents too sharp a bend at the ends where the cable drops down. Expansion joints at each of the two towers (Fig. 5) provide for longitudinal movement of the roadway due to wind, temperature, etc. The width of this open joint may vary from 11 in. to 6 ft. 2 in. The problem was to bring the electric cables across this varying distance so that they would not be subject to undue wear and deterioration of the insulation. As installed on the bridge, the rigid conduits are terminated some distance back from the joint and to them is fastened a flexible steel conduit. A ¼-in. steel plate guards against too sharp an angle of bend.

Support of the electrical cables for the lighting of the

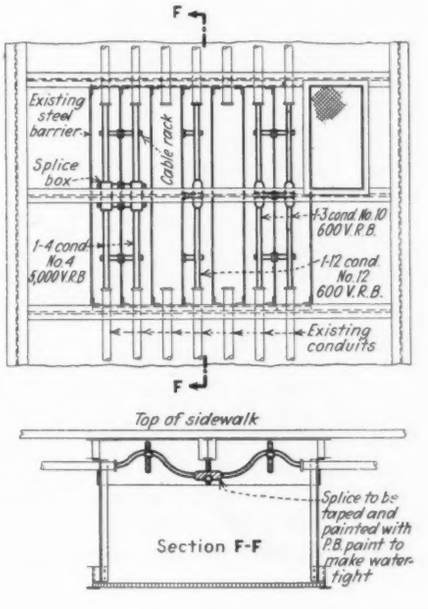


Fig. 3—Conduit splicing chambers placed at 400-ft. intervals

The cables can bend when the bridge expands and contracts.

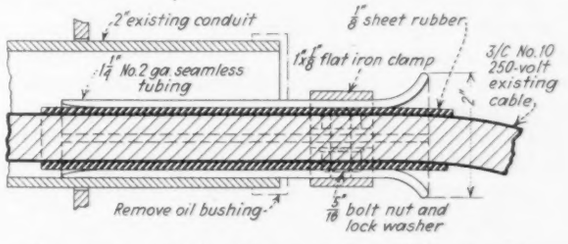

2" existing conduit
⅛" sheet rubber
1¼" No.2 ga. seamless tubing
1"x⅛" flat iron clamp
3/C No.10 250-volt existing cable
Remove oil bushing
⅝" bolt nut and lock washer

Fig. 4—Special bushing protects cable at emergence from conduit into splicing chamber

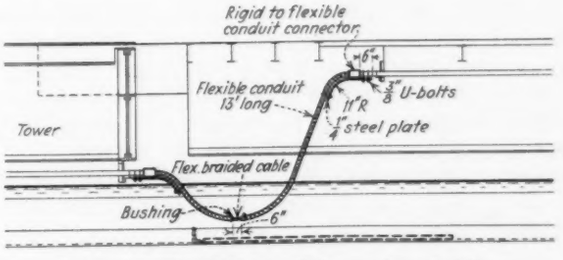


Fig. 5—Flexible conduit used at bridge expansion joints

The open joint A at each tower ranges from 11 in. to more than 6 ft. under temperature and wind variations. This flexible cable insert prevents undue wear and insulation deterioration. A ¼-in. steel plate is bent to form a support for the cable at each end of its loop.

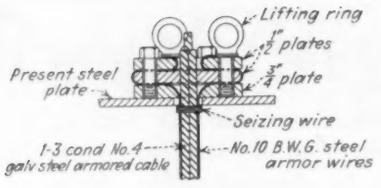


Fig. 6 — Armor wires suspend lighting cables for vertical runs up towers to reach bridge suspension cables

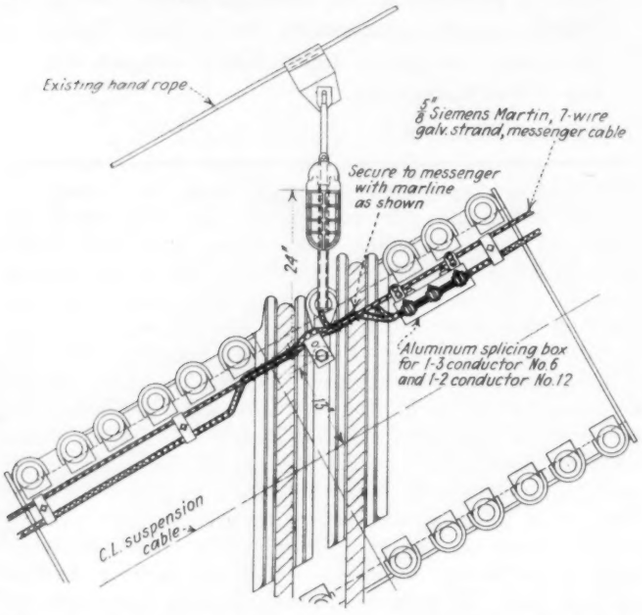

Existing hand rope
5/8" Siemens Martin, 7-wire galv. strand, messenger cable
Secure to messenger with marline as shown
24'
Aluminum splicing box for 1-3 conductor No.6 and 1-2 conductor No.12
C.L. suspension cable

Fig. 7—Aviation lighting cables attached to the bridge suspension cables

The lights are clamped to the hand rope which runs above and parallel to the suspension cable. Taps for the lights are made in G & W aluminum splicing boxes.

main suspension cables of the bridge presents an entirely different problem. Conduit is impracticable here so the cables themselves are given a grounded metal covering for mechanical protection. This protects maintenance men from shock in touching a cable in which the insulation may have become defective. Such a shock, even slight, might cause a man to lose his balance, with fatal results, on account of his dangerous position atop the sloping suspension cables. These lights are fed by electrical cables run vertically to the top of each tower and thence by cables suspended from a messenger alongside the bridge suspension cables. Lighting outlets are located 60 ft. apart at each of the vertical supporting cables running down to the roadway structure of the bridge.

Vertical riser cables are made up of three No. 4 A.W.G. stranded conductors with rubber insulation, standard for 600 volts, jute fillers, tape, and outside jacket of asphaltum saturated jute and an outside spirally wound steel armor wire (No. 10 galvanized). At the top of the tower this armor wire is fanned out and clamped between blocks to support the cable weight. These cables are also clamped to the structure of the tower every 8 ft. (Fig. 6) to prevent the armor from untwisting and thus throwing the weight of the cable on the copper conductors.

Cables from which the aviation lights on the main suspension cables are served are three-conductor, rubber-insulated No. 6 A.W.G. stranded wire made up similarly to the risers except that the metal sheathing consists of a wire braid. This is attached to the messenger by malleable iron clamps (Fig. 7) at intervals of 3 ft. Further to protect the cable at the joint a splicing box was bolted around it after installation and filled with compound. Taps for the lights were made in the factory and come out from the under side.

Navigation lights are located under the roadway at the center of the channel and on each side of the channel, as well as on the north and south faces of the New Jersey pier near the water line. The cables for the lights under the roadway have two conductors of No. 6 A.W.G. extra-flexible copper with a rubber covering of 40 per cent rubber compound $\frac{1}{16}$ in. thick. There is a soft cotton filling impregnated with insulating compound and a covering of rubber-filled tape and an impregnated double cotton braid. These lights are so arranged that they can be raised in guides to the level of the roadway for maintenance. The lights on the piers are fed by armored cable dropped down from the roadway and supported similarly to the risers up the towers for the aviation lighting. These lighting units and their manner of installation comply with the requirements of the Board of Lighthouses, Department of Commerce. The lens is about 7 in. wide by 14 in. high and there are two 100-watt bulbs, each fed from one of the two separate sources of supply.

Pumpless Arc Rectifiers Hold Vacuum Successfully

Large-capacity, steel-cylinder, mercury-arc rectifiers without vacuum pump and water cooling have been developed in Germany. One has been in operation for more than six months without loss of vacuum. The experimental work and results of tests are described by W. Dallenbach in the *Elektrotechnische Zeitschrift,* No. 4, 1934.

When a welded steel cylinder is heated, after evacuating, it is found that a considerable quantity of gas is liberated from the walls. This quantity is reduced after a temperature of 400 deg. C. is reached. The gas is both from the surface and a certain amount of hydrogen from the continuation of the metallurgical process of steel manufacture. If a water-cooled steel cylinder rectifier is degassed for several days at this limiting temperature, then cooled and operated with circulating water for several hours, a gas analysis shows almost pure hydrogen to be present. Hydrogen is thought to be in atomic form in the water and readily diffused through the walls of the tank. This liberation of hydrogen from the walls of the tank and also from the anodes in operation is thought to be a contributory cause of backfiring.

To eliminate hydrogen diffusing in the experimental unit a cooling medium other than water was used which did not contain hydrogen. The vapor of the cooling medium is condensed in a cooling tower by means of fan cooling. The specially devised anode seal is capable of withstanding the temperature of 400 deg. C. at which the unit is maintained during the short "forming" period with vacuum pump attached to degas and produce the operating vacuum. The unit which was constructed for test is a six-phase unit with a full load rating of 640 amp. d.c. It has been in operation for more than six months and the vacuum has been maintained successfully throughout the period.

Operating Experience With Grounded Neutral Encouraging

By D. M. BUNN . . . M. T. JAMIESON
Northern States Power Company

With several years of operating experience behind them, engineers of the Northern States Power Company are now prepared to report upon results with their 4-kv. common neutral grounded system of distribution. That an exceedingly satisfactory record of interruptions and failures has been maintained has been of assistance to those engineers and will aid others who would profit by their experience.

DURING the past several years engineers from many utilities have made inquiries regarding the use of our 4-kv. common neutral grounded system of distribution as well as inquiries regarding our operating experience while using lightning arrester grounding by interconnection. In order that we might know, as well as to obtain information which might be of interest and benefit to the electrical industry in general, we have kept records of distribution operating data which would either prove or disprove our theories regarding this type of distribution system. From these records it is now possible to determine the total number, the percentages and the cause of transformer, fuse and lightning arrester interruptions and failures.

The records tell the story

The following data cover some of the records as kept for the year 1933 as well as a few summaries and comparisons of reports of previous years. In analyzing these figures the following pertinent facts should be kept in mind: Transformers covered in this report are all protected by lightning arresters and primary fuse cutouts fused, for the most part, at 1 amp. per kva. Lightning arresters are connected to the primary on the line side of the transformer fuse cutout and the ground lead is connected to the neutral wire, which is the common ground wire for the secondary system as well as the 4-kv. star-connected primary system. The resistance to ground of this common neutral wire, in the vast majority of cases, is less than 1 ohm and rarely more than 3 ohms. The grounding practice used is shown in the accompanying illustration. The 1933 distribution transformer and transformer fuse operation record for the Minneapolis division is shown in Table I.

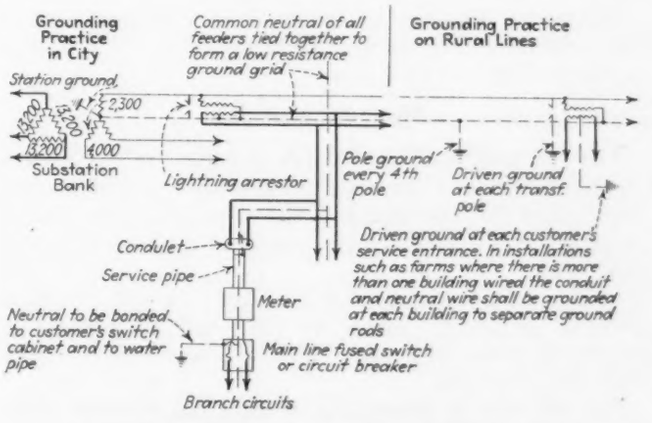
The Minneapolis district has an approximate area of 510 square miles, served at present by 5,866 distribution transformers. Of this number, thirteen transformers, or 0.22 per cent, were burned out due to all causes during the year 1933. The record shows, in detail, the various sizes and the conditions responsible for the transformer failures. Considering the fact that only three distribution transformers, or 0.051 per cent of the total number, were burned out due to lightning, it seems quite conclusive evidence that the lightning arrester connections, as used by this company since 1920 and which have in the past few years become commonly known as lightning arrester grounding by interconnection, are highly satisfactory.

Comparative figures taken from annual reports since 1920 are given in Table II, which shows a marked decrease in transformer failures, and we feel that it is a remarkably good transformer operating record.

That portion of the 1933 transformer record headed "Minnetonka district" includes 837 transformers. The Minnetonka district is a suburban area which includes several small communities, summer resorts and rural territory surrounding the Minnetonka lakes. The approximate area of this district is 130 square miles.

Changing of the Minnetonka district primary distribution system from 2,300 volts delta to a 4-kv. star-common neutral grounded system has been under way for several years and was just completed in 1932. This is the first complete transformer and fuse operation report made under these conditions.

With a total of three transformer burnouts, or 0.35 per cent of the total of 837 transformers, it appears that this area will compare very favorably with the Minneapolis area as to percentage of transformer burnouts due to all causes. Although there were two burnouts due


Grounding Practice in City
Common neutral of all feeders tied together to form a low resistance ground grid
Grounding Practice on Rural Lines
Station ground
2,300
13,200
4,000
Substation Bank
Lightning arrestor
Pole ground every 4th pole
Driven ground at each transf. pole
Conduit
Service pipe
Meter
Driven ground at each customer's service entrance. In installations such as farms where there is more than one building wired the conduit and neutral wire shall be grounded at each building to separate ground rods
Neutral to be bonded to customer's switch cabinet and to water pipe
Main line fused switch or circuit breaker
Branch circuits

Grounding practice in common neutral system used in Minneapolis

Abstract of paper presented to equipment committee, Edison Electric Institute.

Table I—Transformer Record—1933—Minneapolis Division—

Minneapolis District

Size of Transformer	1½	2	3	5	7½	10	15	20	25	30	37½	40	50	75	100
Number in Service	110	21	581	647	402	815	1,209	423	552	117	375	26	273	110	113
Total kva	165	42	1,743	3,235	3,015	8,150	18,135	8,460	13,800	3,510	14,063	1,040	13,650	8,250	11,300
% of total transformers	1.87	.36	9.91	11.03	6.85	13.89	20.61	7.21	9.41	1.99	6.39	0.44	4.66	1.88	1.93
% of total kva	0.12	0.03	1.31	2.42	2.26	6.10	13.58	6.34	10.34	2.63	10.54	0.78	10.22	6.18	8.46
No. Transf. Fuses Blown Due to															
Overload	....	....	....	1	3	21	1	....	3	5	.....	....	.....	....	.....
Shorts on sec. or cust. wiring	....	....	....	5	2	9	12	3	5	....	.....	....	1	1	....
Shorts caused by bldg. fires	....	....	....	2	1	2	4	....	....	....	.....	....	2	....	.....
Lightning	....	....	4	3	2	5	2	....	....	....	.....	....	.....	....	.....
Faulty equipment	....	....	....	.....	....	1	1	....	....	1	.....	....	.....	....	.....
Cause not known	....	....	4	5	3	16	10	1	1	2	1	....	3	....	1
Total	....	....	8	16	11	54	30	4	9	8	1	....	6	1	1
No. Transf. Burned Out Due to															
Overload	1	....	1	.....	2	....	.....	....	....	1	.....	....	.....	1	.....
Shorts on sec. or cust. wiring	....	....	....	.....	1	....	.....	....	....	1	.....	....	.....	....	.....
Lightning	1	....	....	1	....	1	.....	....	....	....	.....	....	.....	....	.....
Cause not known	....	....	....	.....	....	1	1	....	....	....	.....	....	.....	....	.....
Total	2	....	1	1	3	2	1	....	....	2	.....	....	.....	1	.....

(NOTE: Two bushings were destroyed by lightning, but transformers were not burned out)

Lake Minnetonka District

Number in Service	69	12	182	250	104	152	39	1	15	1	8	....	1	....	3
Total kva	103	24	546	750	780	1,520	585	20	375	30	300	....	50	....	300
% of total transformers	8.2	1.5	21.7	29.8	12.5	18.2	4.7	0.1	1.8	0.1	1.0	....	0.1	....	0.3
% of total kva	1.7	0.4	9.3	21.2	13.3	25.9	9.9	0.3	6.4	0.5	5.1	....	0.9	....	5.1
No. Transf. Fuses Blown Out Due to															
Overload	....	....	1	4	....	1	.....	....	1	....	.....	....	.....	....	.....
Short on sec. or cust. wiring	1	....	1	2	1	5	.....	....	....	....	.....	....	.....	....	.....
Short caused by bldg. fires	....	....	....	1	....	....	.....	....	....	....	.....	....	.....	....	.....
Lightning	2	....	1	1	....	....	.....	....	....	....	.....	....	.....	....	.....
Cause not known	....	....	....	1	....	1	.....	....	....	....	.....	....	.....	....	.....
Total	3	....	3	9	1	7	.....	....	1	....	.....	....	.....	....	.....
No. Transf. Burned Out Due to															
Overload	....	....	1	.....	....	....	.....	....	....	....	.....	....	.....	....	.....
Lightning	1	....	1	(3 Kva. burn-out due to lightning jumping from tree to trans. single service)											
Total	1	....	2	.....	....	....	.....	....	....	....	.....	....	.....	....	.....

to lightning, 0.23 per cent of total transformers, both were due to direct strokes, one being on the primary system and one on the secondary service from the transformer. Considering the fact that this entire area has relatively few grounds on the common neutral system, as compared to the Minneapolis district, the results seem very gratifying.

Prior to 1927, when this company purchased the distribution system in the Minnetonka district, it was not required that the consumer have a ground on the secondary neutral at his service entrance. All new customers connected since 1927 have been required to supply a ground at the service entrance and a large number of individual driven grounds were installed at transformer locations at the time the changing over of the primary system from delta to a 4-kv. common neutral grounded system took place.

Meter burnout data

In checking over our records in regard to the number of meter burnouts due to lightning it was found that when the system was operated at 2,300 volts delta there was an average of fifteen burnouts per year that were due to this cause.

Since the system has been cut over to a 4-kv. common neutral grounded system we have had an average of eight burnouts per year, with a maximum of 5,000 meters in service.

It will also be interesting to note that with the 4-kv. common neutral grounded system we have not lost a meter where the service is of the present approved grounded type. All losses have occurred on ungrounded services.

Another argument in favor of the 4-kv. common neutral grounded system is our experience with a farm line. This line is about 2 miles long, built with bare three-strand No. 10 copper primary on four-pin crossarms. During the time we operated this line at 2,300 volts it was hit a great many times. In some cases only transformer fuses were blown; in others, equipment was damaged. We have a record of two transformers, two lightning arresters, one pole and three crossarms being destroyed by lightning on this line. Since the line has been changed over to a 4-kv. common neutral grounded

Table II—Comparative Record of Transformer Burnouts

Minneapolis Division, Excluding Minnetonka District
1920 to 1933, Inclusive

Year	Total No. of Transf. in Serv.	No. of Burnouts Due to All Causes	% of Burnouts of Total No. of Transf.	No. of Burnouts Due to Lightning	% of Total No. of Burnouts Due to Lightning
1920	2855	45	1.58	..	....
1921	2921	51	1.75	..	....
1922	3183	40	1.26	..	....
1923	3269	16	.49	..	....
1924	3188	41	1.28	..	....
1925	3428	58	1.69	..	....
1926	3950	25	.63	..	....
1927	4032	15	.372	..	....
1928	4225	15	.355	9	60.0
1929	4679	7	.150	2	28.6
1930	4937	16	.344	5	31.3
1931	5402	13	.241	6	46.2
1932	5667	9	.158	7	77.8
1933	5866	13	.222	3	23 0

Excluding St. Croix District

150	200	300	500	Total No. of Transf. & Fuses	Total Kva.	
43	10	15	24	5,866	.....	
6,450	2,000	4,500	12,000	....	133,508	
0.74	0.17	0.26	0.41	....	.....	
4.83	1.50	3.37	8.99	....	.....	
						% of Total Fuses Blown
....	....	....	.....	34	477½	22.8
....	....	....	.....	38	620	25.5
....	....	....	.....	11	197½	7.4
....	....	....	.....	16	122	10.7
....	....	....	.....	3	55	2.0
....	....	....	....	47	762	31.6
....	....	....	.....	149	2,234	2.54 (% of total no. fuses)
						% of Total Transf. Burned Out
....	....	....	.....	6	124½	46.2
....	....	....	.....	2	37½	15.4
....	....	....	.....	3	16½	23.0
....	....	....	.....	2	25	15.4
....	....	....	.....	13	203½	0.222 (% of total transf.)
....	....	....	.....	837	.....	
....	....	....	.....	....	5,883	
....	....	....	.....	....	.....	
....	....	....	.....	....	.....	
						% of Total Fuses Blown
....	....	....	.....	7	58	29.1
....	....	....	....	10	72	41.6
....	....	....	.....	1	5	4.2
....	....	....	.....	4	11	16.7
....	....	....	.....	2	15	8.4
....	....	....	.....	24	161	2.87 (% of total no. of fuses)
						% of Total Transf. Burned Out
....	....	....	.....	1	3	33.3
....	....	....	.....	2	4½	66.7
....	....	....	.. ..	3	7½	0.358 (% of total transf.)

system, using interconnection method of lightning arrester grounding, we have not had so much as a blown transformer fuse.

It is also of interest to note that since changing over the Minneapolis distribution system of primaries from 2,300 volts delta to 4 kv. star, using common neutral grounded system and the interconnected lightning arrester grounds, the number of meter potential coils

Table III—Resistance in Ohms of the Common Neutral and Isolated Ground Rods to Ground

(½-In. to 10-Ft. Rods)

Neutral and Rod Together	Rod Separate	Kind of Soil	Condition of Soil
1.02	20.0	Sand	Dry
.82	13.7	Peat bog	Moist
1.17	170.0	Sandy clay	Damp
1.91	12.3	Clay	Moist
2.02	34.0	Clay	Moist
2.12	42.0	Sandy clay	Moist
1.39	12.7	Clay	Moist
1.12	29.5	Peat bog	Moist
1.47	89.0	Sand and clay	Moist
1.52	11.5	Yellow clay	Moist
1.22	17.0	Sandy loam	Moist
1.07	19.5	Sandy loam	Moist
1.02	14.0	Yellow sand and clay	Moist
.82	12.5	Sand	Moist
.87	20.6	Sandy loam	Moist
.79	15.0	Sandy loam	Moist
.72	11.0	Sand and clay	Moist
.82	11.5	Sand and clay	Moist
.92	10.7	Sandy clay	Moist
.92	9.5	Clay	Wet
.99	13.4	Sandy loam	Moist

burned out due to lightning has been materially reduced.

The successful and safe operation of either the common neutral system or any system using the so-called "interconnection" method of lightning arrester protection depends on the adequacy of the grounding system. It is a well-established fact that where a multiplicity of water pipe grounds exists on the secondary services, as is the case in urban districts, the resistance to ground of the neutral conductor is very low and furnishes a highly reliable lightning arrester ground.

Changing of the Minneapolis city distribution feeders to a 4-kv. common neutral grounded system was carried out over a number of years and was completed in 1924. At that time a survey was made over the city and the ground resistance taken at 122 locations. Highest resistance at that time was 1.5 ohms and lowest 0.10 ohm. Since that time hundreds of additional ground connections to the common neutral have been made through the connection of new customers.

Our operating experience, as indicated in the above records, has been practically ideal and is, for the most part, due to the reliability of the ground system.

Experience on rural lines satisfactory

In the minds of many engineers the advisability of using the interconnection method of lightning arrester protection on rural lines is rather questionable. Our rural line experience, however, has been highly satisfactory while using the interconnection in conjunction with our common neutral system. Approximately 700 miles of suburban and rural lines of this type are now giving practically uninterrupted and hazard-free service in the Minneapolis division.

We have often been asked how many cases of failure of customers' equipment and wiring we have had on our system, also the number of accidents which can be traced to excessive voltage being introduced on customers' premises.

We find, by checking with the city electrical inspector and with our own service department, that there has not been a single case of trouble or damage to interior wiring due to excessive voltage which has been experienced since the common grounded neutral and the interconnection method of lightning arrester grounding has been in general use throughout the city. During this time we have had experience with the 4-kv. primaries crossing up with secondary wires and services during storms, 13-kv. short circuits to the 4-kv. primaries, as well as having had a number of lightning arresters completely broken down due to lightning and other causes, such as water getting into the arrester, causing corrosive deposits to close the spark gap and resulting in a primary power current flowing into the common neutral. In many of such cases the arresters have been completely destroyed, while in other cases the primary or ground lead would burn off or the feeder circuit breaker would open at the substation. In none of these cases has any trouble been experienced on the customers' interior wiring or equipment due to excessive voltage.

On our suburban and rural lines neither our own wiring inspector nor the service department has any records of any damage having occurred on customers' wiring due to excessive voltage because of lightning arresters being connected to the common grounded neutral. Ground tests made at random on our rural 4-kv. common grounded neutral lines, shown in Table II,

indicate the superiority of this system of multiple grounding as compared to individual ground rods.

The following 1933 record of various makes of distribution lightning arresters shows the number of replacements of each make of arrester and, to a certain degree, indicates the durability of the different makes:

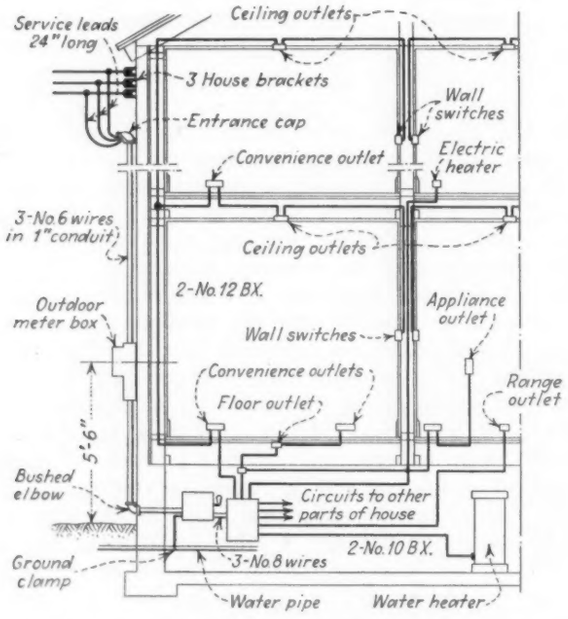
Manufacturer	No. in Service	Replacements for All Causes	% of Total of Each Make
A	3,921	19	0.48
B	1,578	20	1.20
C	895	11	1.23

The arresters indicated above include all of those replaced for such reasons as radio interference, mechanical breakage, electrical burnouts due to corrosion within the arrester, as well as those destroyed by direct strokes of lightning. The latter cause is the one which is responsible for the majority of failures of arresters as well as transformer failures.

Outdoor Meters Installed According to Southern Standards

Meter installation regulations of Southern Public Utilities Company require that, as far as practicable, outdoor meter boxes are to be installed on all new wiring of single-phase services. It also applies to some rearranged wiring or addition to existing circuits where the capacity does not exceed 60 amp. if switch and fuses are used; when circuit breakers are used the limiting capacity is 70 amp.

The outdoor box is located about 5½ ft. from the ground. A 60-amp. entrance switch is placed inside close to the entrance and the grounding is made to available water pipe at this point. The surface branch circuit cabinet may be installed elsewhere if more feasible. Three No. 6 wires are prescribed as a minimum as far as the switch and three No. 8 wires thence to the branch cabinet.



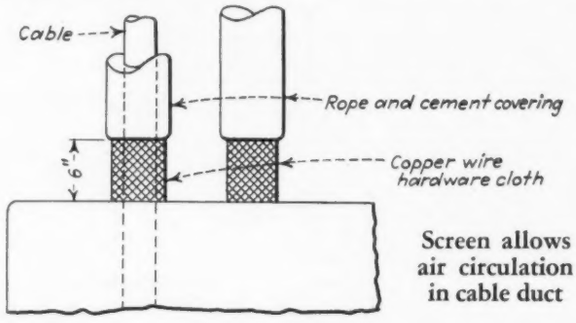
Outdoor meter in box; grounding inside to water pipe

POWER COMPANY

To Let Air Into Cable Ducts

By RICHARD BANZ
Chicago, Ill.

Still air is a good heat insulator and moving air is a good heat dissipator. Therefore the natural flow of air in cable ducts should not be impeded any more than can be helped if unnecessary cable heating is to be avoided.



Screen allows air circulation in cable duct

Wholly or partially closing up duct ends with the protective coatings of rope and cement that are applied to open cable runs imprisons stagnant air in the ducts, retaining heat and lowering cable efficiency.

For ventilating cable ducts a very simple device is in use on the system of the Commonwealth Edison Company whereby the end of the cable duct is left open, allowing a natural circulation of air through the duct. A copper screen guard is installed at the upper end of the duct extending 6 in. above it, thus providing protection against injury to the cable, and keeping débris from falling into the duct. This device, however, is not installed where wiping caps are used.

Ground Lead Impedance Can Spoil Lightning Protection

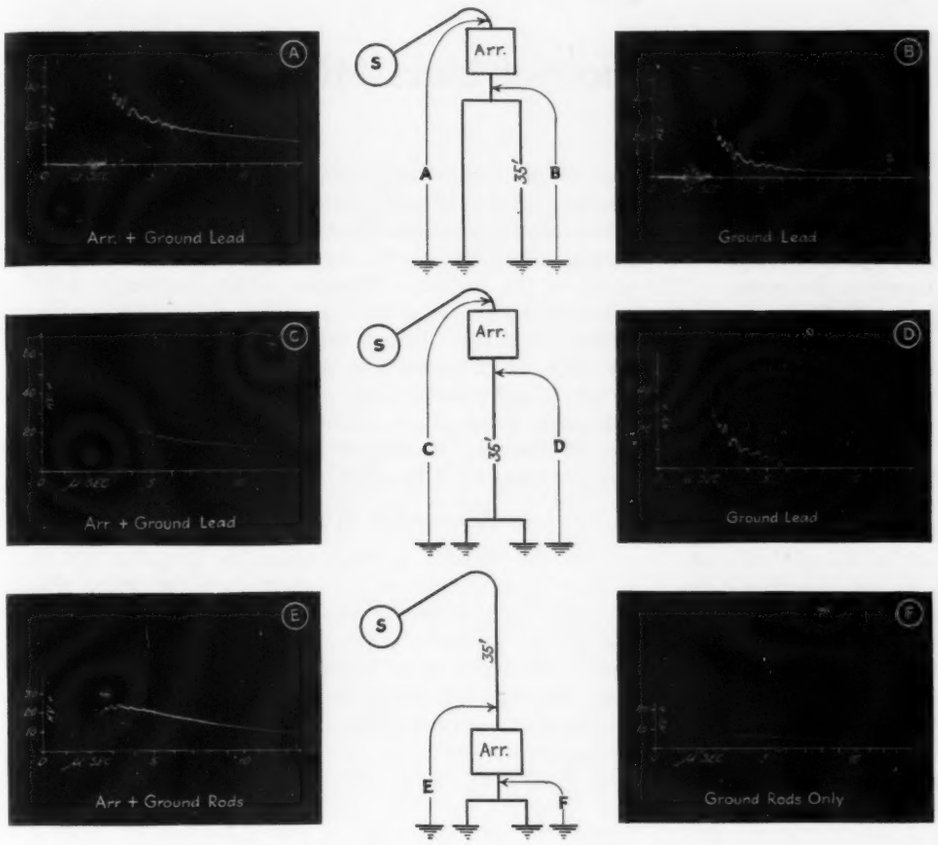
By A. M. OPSAHL
Circuit Breaker Engineering Department,
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The lead grounding a lightning arrester has inductance and the ground itself has resistance. A lightning surge current passing to ground through the arrester and its ground will give rise to a voltage drop across the ground and ground lead which spoils the protection afforded by the lightning arrester by that impedance drop.

In order to get a picture of how great these voltages might be, a field test set-up was made of a lightning arrester on a pole 35 ft. above the ground level. The ground lead was connected to two driven grounds having a resistance to earth of about 6 ohms. The lightning arrester was a 3,000-volt LV, of a type that has been in service since 1922.

An artificial lightning surge of 1,200 amp. was impressed on the above assembly and the oscillogram C was recorded by a cathode-ray oscillograph. The crest voltage measured from the line to ground was 58,000, of which some 40,000 volts was due

ENGINEERING PRACTICE



to inductive drop and resistance drop of the ground lead and ground as shown in oscillogram D. The lightning arrester was then moved down to the ground, leaving the remainder of the circuit the same. The crest voltage measured across the lightning arrester and ground resistance was about 24,000 volts, as shown in oscillogram E, of which about 7,000 volts was due to IR drop in the ground resistance.

It had been suggested that parallel ground leads might eliminate some of this inductive drop, so two ground leads were run down on opposite sides of the pole and each connected to a ground rod. It can be seen by a comparison of oscillograms A with C and B with D that the inductive drop is reduced, but that it is still high.

From these tests it is evident that even a low resistance ground for the lightning arrester does not assure adequate protection. This ground must also have a low inductance. The voltage drop due to the inductance of the ground lead is directly proportional to the rate of rise of the surge current. The voltages measured in this case were determined by the particular current surge which was used.

In order to obtain the maximum lightning protection by means of an arrester, the arrester should be connected as directly as possible across the insulation to be protected.*

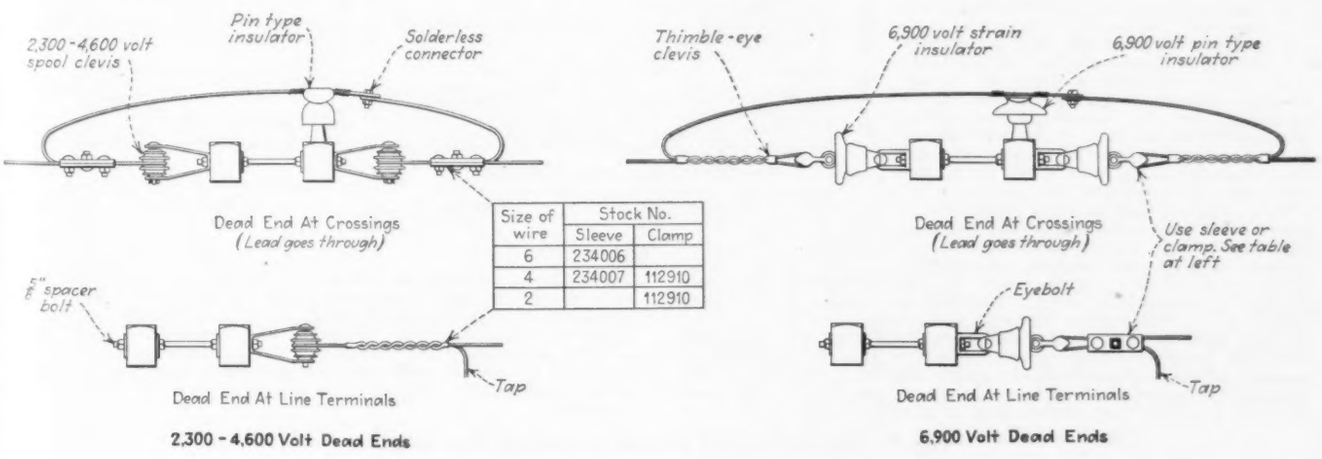
*"*Surge Protection for Distribution Transformers,*" P. F. Squier, "*Electric Journal,*" September, 1932; "*Lightning Protection for Distribution Transformers,*" A. M. Opsahl, A. S. Brookes and R. N. Southgate, A.I.E.E. Trans., March, 1932.*

Inductance of ground lead important in lightning protection

The wave used in these tests rose to 1,200 amp. in 2 microseconds and dropped to 600 amp. in 10 microseconds. Ground lead impedance creates about 33,000 volts drop exclusive of the 7,000 volts in the ground itself.

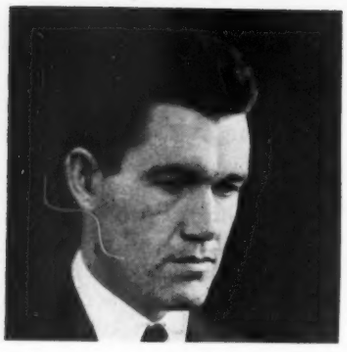
For Better 6,900-Volt Dead-Ends

The loop of a dead-end is often an unsightly mess. Either a necessary pin insulator is omitted by false economy or the loop is left too long or a sloppy splice is made. Both ends of the dead-end should be cut off, one of the pigtails should be supported on a pin insulator and the other pigtail joined to it by means of solderless connector. The accompanying illustration shows neat and satisfactory methods for making neat dead-end loops, also a simple tap dead end on primary 2,300 to 6,900 volts, adapted as standard on the West Penn System.



Lightning Flashovers —

Increased Insulation of Lines May Only Transfer



By
L. V. BEWLEY
Transformer Engineering Department,
General Electric Company,
Schenectady, N. Y.

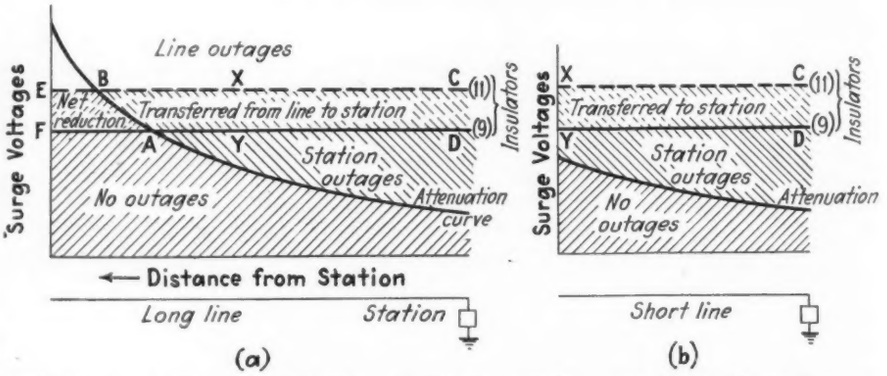
ADVANCES of higher line insulation as a means of reducing system outages may fail in its purpose by increasing the outages at the station to as great an extent as it reduces the outages on the line proper. There is, in fact, a critical length of line for which an increase of insulation will bring about no change in the number of outages; if the line is less than this critical length the total outages will remain unchanged by the addition of line insulation, while if the line is longer than this critical length the total system outages will be decreased. These remarks apply specifically to overhead lines without ground wire protection and without lightning arresters at the station.

If modern lightning arresters are installed at the station, then an increase of line insulation will invariably result in a decrease of total system outages. Thus the practice of using highly insulated lines (wood poles with underground hardware, for example), particularly on short lines, and failing to provide adequate lightning arresters at the end stations will result in no fewer system outages than would incur for less line insulation, or grounded hardware.

The reason for this seeming paradox lies in the fact that surges originating out on the line travel to the station and there practically double in magnitude if lightning arresters are not used. Now if this double crest value is greater than the station flashover level, an outage will occur at the station. Whether or not the surge will be sufficient to flashover at the station after doubling there depends upon two things—the magnitude of the surge at its point of inception and the attenuation suffered by it in traveling to the station. Obviously, the amplitude of the surge at its origin cannot exceed the flashover voltage of the line insulation if it is to reach the station without causing a line outage.

Attenuation fixes terminal zone

The attenuation depends upon the distance traveled, the original voltage of the surge and the wave shape, particularly the length of the wave. The higher the voltage the greater the attenuation, and short or chopped waves attenuate more rapidly than long waves. There thus extends out from the station a "terminal zone" within which surges below the flashover value of the line insulation may originate and travel to the station, where they double in value and precipitate a station flashover and outage. This terminal zone extends out some 3 miles for very short waves and 12 miles or more for long waves. *Increasing the line insulation extends the limit of this terminal zone and therefore subjects the station to a larger number of surges exceeding its flashover voltage.* Consequently, with the increase of line insulation the line outages proper will decrease, but the station outages will increase. Which tendency will dominate will depend on the length of the line. If the line is short the entire line is within the terminal zone and a large proportion of the total outages will occur



The attenuation curve shows the voltage at any point on the line necessary to precipitate a station flashover, taking into account the reflection of the traveling wave at the station. The horizontal line represents the surge voltage necessary to cause a line insulator flashover. Obviously, then, any surge voltage which lies below both the insulation level of the line and the attenuation curve will result in no outage. A surge voltage which lies above the attenuation curve but below the line insulation level will result in a station outage. Finally, any surge voltage greater than the line insulation level will flashover a line insulator and result in a line outage.

Now suppose that the line insulation is increased. Then all surges in the area ABXCDY of (a), which were formerly line outages, now become station outages, because these surges now lie below the line insulation level but above the attenuation curve. However, all surges in the area ABEF of (a) which were formerly line outages now result in no outages because such surges lie below both the line insulation level and the attenuation curve. Therefore, the area ABEF is a measure of the net reduction of outages due to an increase of line insulation. But if the length of the line is equal to or less than AD, say YD, then (b) applies, and it is evident that there is no net reduction of outages—merely a transfer of former line outages to station outages as represented by the area XCDY. Consequently it is evident that there is a critical length of line for which an increase of line insulation will increase the station outages to the same extent that it decreases the line outages. If the length of the line exceeds this critical length, then an increase of line insulation will result in a net reduction of total system outages.

Fig. 1—Flashovers are related to critical line length

On the Line or at the Station?

the Trouble Unless Adequate Protection Is Provided

at the station, but for very long lines the terminal zone becomes a fraction of the total line length, and so the saving in line outages proper will more than balance the increase of station outages brought about by an increase of line insulation.

The relationship between station and line outages is illustrated in Fig. 1 for a long and a short line. It is clear from analysis of that figure that the critical length of line depends upon the attenuation curve, the station insulation and the line insulation. The higher the station insulation and the higher the rate of attenuation the shorter the critical length. Thus the critical length is less for short waves than for long waves, because the former have a higher rate of attenuation. The Foust and Menger empirical attenuation formula is:

$$e = \frac{E}{1 + KEx} \text{ or } E = \frac{e}{1 - Kex}$$

where
x = miles of travel
E = voltage of surge at point of origin
e = voltage of surge after x miles of travel
K = attenuation constant
= (approximately) 0.0006 for chopped waves
= (approximately) 0.0003 for short waves
= (approximately) 0.00016 for long waves

If the voltage e is that necessary to cause a station gap flashover then E is the corresponding voltage at the point of origin of the surge.

In order to arrive at some definite idea as to the number of outages it is necessary to have a lightning distribution curve for surges on the line. Fig. 2 is such a curve, compiled from experience on five different systems.† This curve shows the percentage of strokes exceeding any specified voltage.

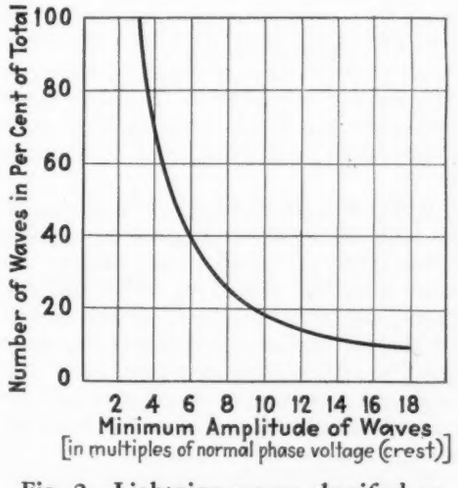


Fig. 2—Lightning waves classified as to amplitude at origin

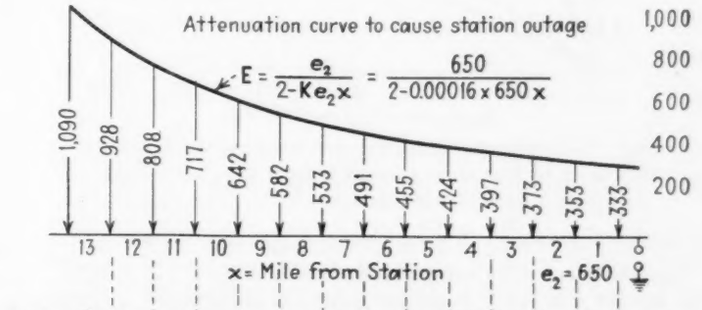
All waves less than three times normal have been disregarded.

Solving the lightning problem is a matter of coordinating the corrective efforts and the values, as every engineer is beginning to understand. Unless lightning arresters are used, outages may merely be shifted from line to station. No real reduction in outages or flashovers* may result. This is especially true of the shorter line, where attenuation of the waves has less chance to help.

A 132-kv. transmission line whose station gap is set for 650 kv. is shown in Fig. 3. The attenuation curve is according to the Foust and Menger formula with $K = 0.00016$. The line has been divided into one-mile intervals and 100 surges are taken to originate on each interval (assumed concentrated at the midpoint of the interval), the voltage distribution being in accordance with Fig. 2. The two tabulations are for nine and eleven insulator units respectively. For example, between the 6- and 7-mile points 26 of the 100 surges exceed the line insulation for nine insulator units and therefore cause a line outage, while 55 of them exceed the voltage on the attenuation curve. Thus (55 — 26) = 29 of the surges originating on this interval will not cause a line outage, but will travel to the station and cause a station outage. Adding all of these differences

**The author evidently is using "flashover" and "outage" as identical for the purposes of this discussion.*

†*"Lightning Investigation on Transmission Lines—II," by W. W. Lewis and C. M. Foust, A.I.E.E. Transactions, Vol. 50, September, 1931.*



Surges	(9) Insulator units e_1 = 870												Σ
% > E	24	28	35	40	45	50	55	62	69	75	82	90	98	
% > e_1	26	26	26	26	26	26	26	26	26	26	26	26	26	
Excess	-	2	9	14	19	24	29	36	43	49	56	64	72	417

Surges	(11) Insulator units e_1 = 1,070													Σ
% > E	24	28	35	40	45	50	55	62	69	75	82	90	98	
% > e_1	18	18	18	18	18	18	18	18	18	18	18	18	18	
Excess	6	10	17	22	27	32	37	44	51	57	64	72	80	519

Fig. 3—Higher insulation sends flashovers to station

gives a total of 417 station outages. The critical length of line beyond which all the outages are on the line itself is 12 miles, because for greater distances the attenuation curve requires a higher voltage than the line insulation flashover voltage. For eleven insulator units the total station outages have increased to 519 (out to the critical length). Now the total outages on a line of given length are equal to the total line outages plus the station outages at each end due to surges on the adjacent half length of line. Consequently a surge which causes a flashover at both stations is assigned to the nearest station as a single outage. In this way there is no duplication. Thus on a 20-mile line with nine insulator units the independent station gap outages for both ends are equal to twice the sum of the station outages for each mile of the line out to the 10-mile point, which by the first table of Fig. 3 are 812 outages. To this must be added $26 \times 20 = 520$ line outages, giving a total of 1,332 system outages.

Curves of Fig. 4 have been plotted for lines with nine and eleven insulator units and for comparison therewith the outage curves when all station outages are assumed to be saved by a lightning arrester. These curves clearly show that there is nothing to gain on lines shorter than the critical length by increasing line insulation *unless lightning arresters are provided.* For lines longer than the critical length a net reduction of outages is brought about by an increase of line insulation, but here again the gain is not nearly as great as results it lightning

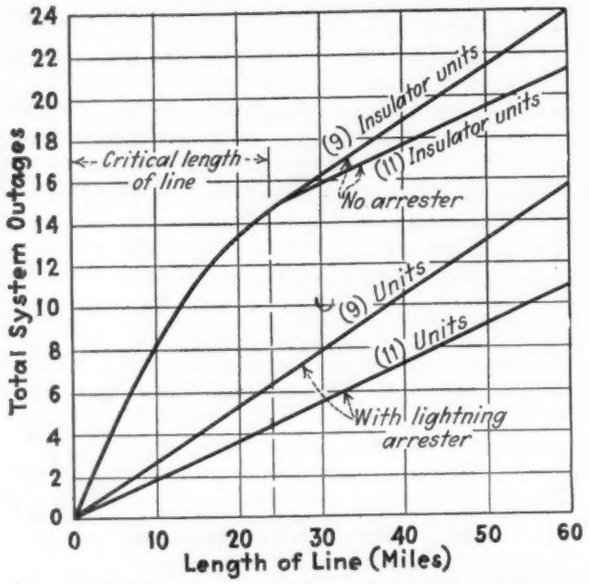


Fig. 4—Lightning arresters are imperative to protect lines of less than critical length that have high insulation

arresters are used. These curves apply to a typical 132-kv. system. On lower voltage circuits the critical length is longer due to the slower rate of attenuation corresponding to the lower level of surges permitted on the lower voltage systems, consequently the greater the percentage of station outages. Thus the lightning arrester plays an even more important part in minimizing outages on lower voltage circuits. It may therefore be concluded:

The advantages of higher line insulation as a means of reducing system outages cannot be fully realized unless the line terminals are protected by adequate lightning arresters.

Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Compton and hope others will discuss industry questions here in a similarly constructive vein.

President

Karl T. Compton predicts . . . that many engineers will become economic specialists

of the Massachusetts Institute of Technology

Applied science will play an ever-increasing rôle in our economic and social life. The increasing necessity for organized co-operation, with economic and social controls, whether along the lines of the "New Deal" or on some different basis, creates an urgent demand for men, engineering training and a broad conception of relative social values and economic processes. It is desirable to develop a co-operative approach to economic problems by the engineer and the economist, in somewhat the same way as has proved so fruitful in the co-operation of the engineer with the physicist, the mathematician, the chemist and the biologist.

In the past it has been predominantly true that social and economic life have been in many respects transformed by the work of the scientist and engineer. The analysis of these changes and the attempt to direct them has, however, been made by an almost entirely separate group of men classically trained only through business or political experience. Out of these conditions I believe there will grow a new field for the engineer. Of course, there will always be a need for engineers who are highly trained in scientific specialties, and who confine their activities to creative work in these fields. Such engineers pursue highly individualistic careers. I believe that there will also be an increasing demand for men of engineering training and broad social interests in the field of public service.

The world needs men of first-class professional training, combined with an understanding of economic processes and a broad conception of social values. A new five-year course with this objective, which will go into effect at the institute next fall, will include essentially the same professional studies as at present in any one of the departments of engineering or science, but will also include an increasing program of more advanced studies in economics and social sciences running through the last three years. On satisfactory completion of the fifth year there will be awarded the degree of bachelor of science in the professional engineering or scientific field, and also the degree of master of science in economics and engineering.

Present Status of Air Conditioning

Air-Conditioning Subcommittee of Edison Electric Institute Makes a Valuable Contribution in a Report Just Published by Chairman C. E. Michel of St. Louis.

TWENTY-SIX power companies have combined their experience in an analysis of the present status of air conditioning just presented by C. E. Michel, chairman of the air-conditioning committee of the Edison Electric Institute. It embraces 269 industrial, 1,220 commercial and 504 "personal" installations, personal here meaning residential or office units for personal comfort. The report represents a total connected load for industrial of 44,515 hp., commercial 134,388 and personal 1,383, on the lines of the following companies:

Commonwealth Edison Company, Chicago.
Union Electric Light & Power Company, St. Louis.
Edison Electric Illuminating Company of Boston.
Pacific Gas & Electric Company, San Francisco.
Union Gas & Electric Company, Cincinnati.
Potomac Electric Power Company, Washington.
Rochester Gas & Electric Company.
Public Service Company of Northern Illinois, Chicago.
New Orleans Public Service Company.
New York Edison Company.
Philadelphia Electric Company.
Northern States Power Company, Minneapolis.
Commonwealth & Southern Corporation, New York.
Nebraska Power Company, Omaha, Neb.
Texas Electric Service Company, Fort Worth.
Public Service Company of Colorado, Denver.
Public Service Electric & Gas Company, Newark.
Memphis Power & Light Company.
Detroit Edison Company.
West Penn Power Company, Pittsburgh.
Duquesne Light Company, Pittsburgh, Pa.
Brooklyn Edison Company.
Consolidated Gas, Electric Light & Power Company, Baltimore.
Des Moines Electric Light Company.
Southern California Edison Company, Los Angeles.
Niagara Hudson Power Company, Buffalo.

These companies serve a population of 20,000,000. The accompanying tables list the classes of business represented by these installations.

Table I—Industrial Classification

Summary of Information Received in Air Conditioning Questionnaire—Reports from 26 Companies

Class of Business	Total Number Installations	Total Horsepower	Average Horsepower	Largest Installation	Smallest Installation
Bakeries	52	947	18	....	....
Candy	60	6,046	101	520	2.5
Chemicals and drugs	16	2,398	150	540	2
Cooperage	2	40	....	....	....
Creameries	3	43	14	....	....
Fruit ripening and storage	5	97	....	40	3
Citrus fruit packing	10	1 650	....	....	....
Food specialties (jello-pecans)	4	34	....	30	1
Leather tanning and manufacturing	3	503	168	266	....
Meat packing	17	2,395	140	....	....
Miscellaneous	22	627	29	....	....
Paper containers	1	75	....	....	....
Photographic films	6	21,748	3,625	....	....
Printing and lithographing	31	3,481	112	350	1
Textiles	20	2,151	108	1,000	25
Tobacco and cigars	12	943	79	....	....
Telephone cable	2	1,153	577	1,085	68
Cork products	1	104	....	....	....
Sugar storage	1	(Not Given)	....	....	....
Oil testing	1	80	....	....	....

Twenty-seven manufacturers also contributed to the report and a variety of data are presented embracing the commercial and industrial uses of air conditioning and installation details over a wide range of service.

Two-thirds of the utilities reportng are promoting air conditioning exclusively through established dealers and manufacturers' branches. All of the others are co-operating to a more or less extent. A majority of the manufacturers have not yet developed definite sales and promotion plans, however, and are proceeding slowly in the development of their distribution.

About a third of the utilities reporting have one or

Table II—Commercial Classification

Summary of Information Received in Air Conditioning Questionnaire

Class of Business	Total Number Installations	Total Horsepower	Average Horsepower	Largest Installation	Smallest Installation
Banks	47	5,058	107	....	..
Beauty and barber shops	8	78	10	30	..
Broadcasting stations	13	852	66	150	..
Brokers board rooms and exchanges	12	956	80	....	..
Business offices	12	599	50	435*	3
Clubs and apartments	9	410	45	....	..
Churches	7	183	26	48	10
Depots	2	23	....	....	..
Florists	1	3	....	....	..
Funeral chapels	38	284	8	21	..
Halls	14	1 111	80	445	..
Hospitals	19	1,155	60	706	..
Hotels	72	9,951	138	....	..
Libraries and museums	7	511	73	327	1
Miscellaneous	6	130	22	50*	..
Medical offices	17	258	...	225*	..
Office buildings	105	12,692	121	2,275	..
Public buildings	38	14,476	...	....	..
Recreation center	1	3	...	....	..
Restaurants	248	7,328	30	....	..
Sales and display rooms	28	235	8	80	..
Schools	19	264	14	....	..
Shoe repair shops	3	7	...	....	..
Stores (department)	44	11,771	268	....	..
Stores and shops (small)	149	1,827	12	....	..
Theaters	301	64,223	213	....	..

Table III—Personal Classification

Summary of Information Received in Air Conditioning Questionnaire

	Total Number of Installations	Total Horsepower	Avg. Horsepower	Equipped with Central Plants	Equipped with Cooling Units
Homes (total)	14	92	6.5	12	2
Homes (partial)	265	507	1.9	54	211
Private offices	225	784	3.5	13	212

more employees whose time is devoted exclusively to air conditioning. But there is so far a divergence of opinion as to how air conditioning should be organized in the work of the commercial department. In some cases it is handled with house heating and others with commercial refrigeration, but with the power sales department checking and approving installations.

Two-thirds of these companies have air-conditioning equipment available for demonstration purposes, some 48 installations in all, and 85 per cent of them have made installations of air-conditioning equipment for some part of their offices or buildings. Manufacturers report that more than half their dealers have air-conditioned rooms for demonstration.

Air conditioning has been actively advertised by the manufacturers for years and it is receiving increasing promotion from the power companies, with all types of advertising media in use. The percentage of utilities and dealers reporting the use of each class of advertising media are as follows:

	Utilities	Manufacturers, Dealers Branches
Direct by mail	85	94
Newspapers	78	82
Window and store displays	52	70
Exhibits	56	70
Demonstrations	56	65
Display or billboards	7½	17½

The general public is now interested in air conditioning and local newspapers are quite willing to print news and information on this subject and a strong volume of publicity is developing in support of this idea.

There is still a wide variance in the terms in which air-conditioning equipment is being sold. Power companies are offering down payments ranging from 10 to 25 per cent and writing contracts for 12 to 36 months. The majority is about 24 months. The time payment charge on the amount financed varies from 6 to 8 per cent, with the latter figure more general. Manufacturers' branches and dealers have developed no unity in the matter of down payments, ranging from 5 per cent to all cash, with 10 and 20 per cent most common. Contracts run from 12 to 30 months and from 12 to 18 most usual. Time payment charges range from 4½ to 10 per cent.

Many classes of dealers are represented in the distribution of air conditioning at present. Manufacturers report them in the following percentages:

	Per Cent		
Heating and ventilating contractors	90	Exclusive agents	21
Plumbers	37	Furnace dealers	16
Public utilities	37	Hardware dealers	10
Factory branches	33	Department stores	10
Electrical specialties	31	Furniture stores	5
Electrical contractors	26	Sheet metal dealers	5
		Theater equipment	5
		Consulting engineers	5

All the companies reported some form of dealer co-operation on air conditioning, embracing the following:

	Per Cent
Educational or general advertising	67
Engineering assistance	59
Assistance in closing sales	56
Use of utilities, demonstration room	52
Use of utilities, sales floor and windows for displays	41
Carrying of customer's time-payment contract	4

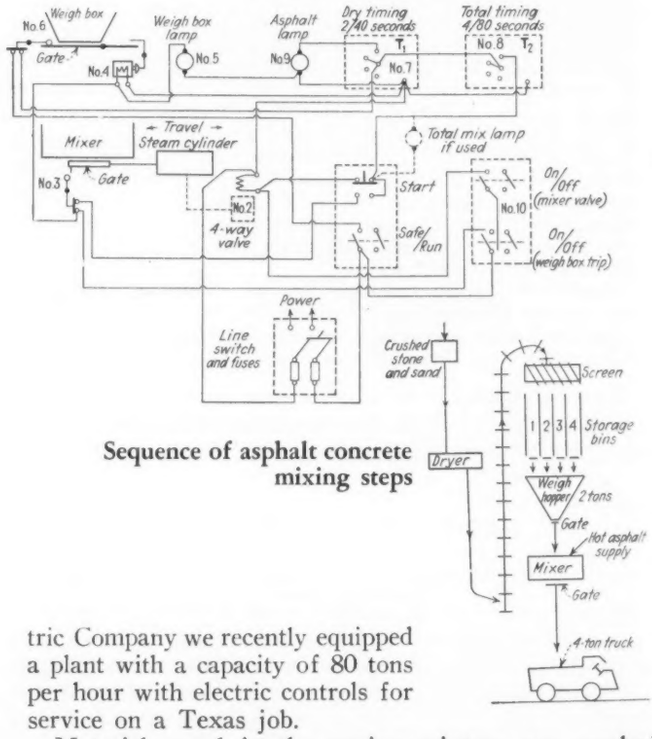
The report suggests practical plans for the promotion of air conditioning by utilities in large and small communities, both through direct merchandising and co-operation with the dealer. It also points out the logical use for ice in summer air conditioning for neighborhood theaters, churches, dance halls and other situations where use is short and the need for cooling does not justify more than a modest investment. It concludes with a review of technical information, new air-conditioning equipment and methods and a bibliography.

Electrical Control Speeds Asphalt Mixing Process

By W. B. SLEMMER
Vice-President Warren Brothers Company, Cambridge, Mass.

Electric controls applied to an asphalt mixing plant of the demountable type used in heavy road construction insure accurate timing of every step in the process. They contribute both to quality production and rapid output. Through the co-operation of the General Electric Company we recently equipped a plant with a capacity of 80 tons per hour with electric controls for service on a Texas job.

Wiring diagram of gate controls for uniform timing of dry and wet mixing.



Sequence of asphalt concrete mixing steps

Materials used in the paving mixture are crushed stone and sand, together with hot asphalt. Crushed stone and sand are passed through a drier at 300 to 400 deg. F. and delivered to a bucket elevator which discharges the material into a revolving screen beneath which are four storage bins for size classification. From the storage bin the aggregate passes into a 2-ton weigh hopper. Asphalt, heated in a separate drum, is also weighed and the hot concrete resulting from the union of the aggregate and the asphalt passes after thorough mixing at a temperature of 450 deg. F. into a 4-ton road truck for delivery on the job, where it is spread at 275 deg. The control of the various gates follows these general lines:

After each batch is dumped from the mixer into the road truck, the mixer gate must be closed to enable succeeding batches to be dumped into it.

The four-way solenoid valve No. 2 is de-energized when button No. 1 is pressed, allowing the mixer valve to assume the "on" position, admitting steam to the actuating cylinder and so closing the mixer gate.

When the mixer gate is closed the limit switch No. 3 makes a contact and this energizes solenoid No. 4, which unlocks the weigh hopper gate, thus discharging the next batch from the weigh hopper into the mixer. When solenoid No. 4 is energized the weigh box pilot lamp No. 5 lights, showing the operator that the mixer gate is closed and that the weigh box gate is open and discharge into the mixer proceeding.

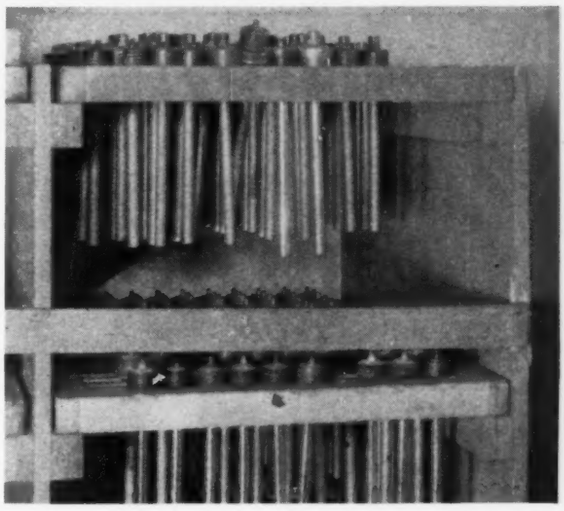
When the weigh hopper gate is again closed contact is made through limit switch No. 6, thus putting into operation two definite time limit relays Nos. 7 and 8. No. 7 time relay gages the dry timing period in the mixer at the end of which the 50-watt pilot lamp No. 9 lights, notifying the operator that the time has arrived for adding the asphalt to the mixer. The dry timing period can be adjusted from 2 to 40 seconds. The time relay No. 8 gages the total mixing period (both dry and wet, with a range of 4 to 80 seconds adjustment), at the end of which period the solenoid four-way valve No. 2 is energized, allowing steam to flow into the cylinder and opening the mixer gate.

In case any of the material stored in the overhead bin is to be withdrawn without going through the mixing operation, this can be handled by a selector switch No. 10, by using which solenoid valve No. 4 (which locks and unlocks the weigh hopper gate) may be energized. With this gate unlocked the four-way solenoid valve No. 2 may also be energized and the mixing gate thus opened, allowing the material in the overhead bin to pass directly through the weigh hopper and mixer to the waiting truck below. This avoids the necessity of having to time this drawn-off material through the various stages which are normally required during actual mixing operations.

Associated with push button No. 1 a switch is provided whereby all the above operations may be cut out. This is done in order that any batch of concrete which might be in the mixer can be held there in case no road truck is in position below it to receive the discharge. Timing operations are all restored by turning this switch to the "on" position.

This interlocking control achieves four major results: (1) A contractor cannot shorten the length of time required for properly mixing every batch; (2) a contractor cannot allow any part of the aggregate to be dumped from the weigh hopper into the mixer until the previous batch has been discharged from the mixer; (3) the dry timing generally specified by various state highway departments is actually obtained uniformly; (4) the wet mixing time (the period after which the asphalt is admitted to the mixer) is also obtained uniformly.

Electric Heat Helps Age Gas-Filled Thermostat Bulbs



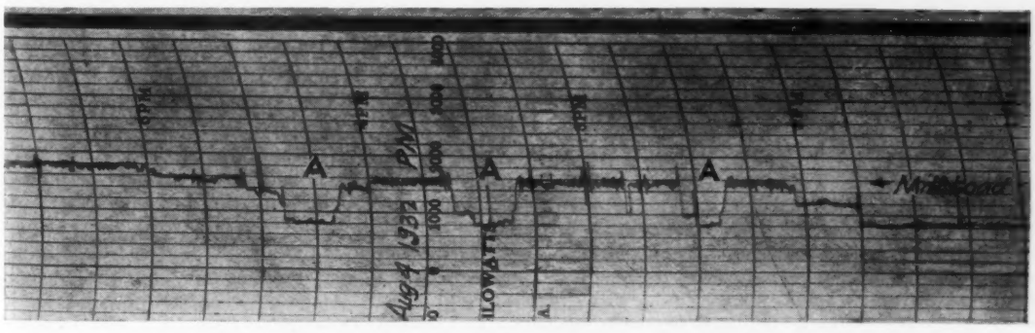
In a special room at the Minneapolis-Honeywell Heat Regulator Company plant at Minneapolis, Minn., a 1½-kw. electric heater, thermostatically controlled, maintains a temperature of 90 deg. F. This level is maintained over periods of two or three months, while gas-filled thermostat bulbs are "stabilized" prior to calibration.

Wattmeter Charts Show Right Grinder Adjustment

By A. P. SCHNYDER
Electrical Engineer
with George F. Hardy, Consulting Engineer, New York

Proper adjustment of the governor on a pulp grinder is readily ascertainable by means of a graphic wattmeter in the line supplying the motor driving the grinder. The inference can also often be drawn from the charts of a wattmeter which embraces a larger portion or the whole of the plant load. Maintaining the right pressure at the grinder means more sustained and uniform production of wood fiber. Better than any other known method, the curve-drawing wattmeter indicates the load characteristic of the grinder and shows if adjustment should be made in the governor system or if the grinder needs to be redressed.

The efficacy of the stone and governor is well illustrated by the accompanying watt chart. At A one grinder lost the load at three successive intervals, resulting in loss of production. The groundwood superintendent could evaluate the behavior of the grinder and put his finger directly on the weak link in the production chain without having to depend exclusively on the word of his men.



Maintenance needs indicated by wattmeter

NEWS OF THE WEEK

T.V.A. Wins Test Against Coal Dealers

Alabama Public Service Commission upholds previous authorization permitting Alabama Power Company to transfer properties to T.V.A.

In the second major test of its program the Tennessee Valley Authority emerged victorious last week when the Alabama Public Service Commission refused to rescind its order of May 30 authorizing the transfer of North Alabama properties of the Alabama Power Company to the T.V.A. A request that the order be rescinded or modified was made by a group of Alabama coal and ice companies which feared "disaster because of the unfair competition of the T.V.A." (ELECTRICAL WORLD, June 23, page 922). The coal and ice companies contended the generation and sale of electricity by T.V.A. at the rates proposed would be detrimental to the state where power could not be sold as cheaply, and that it would curtail the use of ice and coal.

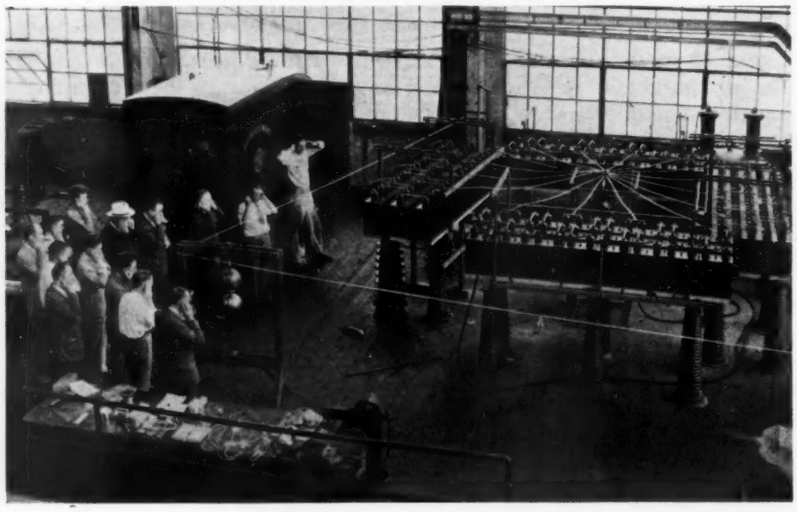
Attorneys for the ice and coal companies contended at the hearing that the Alabama Power Company had to sell the properties under duress and that the price was not more than half their true worth. They further argued that the state would be injured by failing to collect revenue from T.V.A. Summing up the arguments for T.V.A., Borden Burr, attorney, said that "the only question is whether or not the public will be as well served by the purchasing company as by the selling agents." He further asserted that the commission could not question the validity of acts of Congress, that it must assume that the T.V.A. is constitutional, and that its acts will be in the best public interest.

•

Insull Trial Date Set

Final pleas in the case of Samuel Insull and sixteen others accused of using the mails to defraud was overruled this week by Judge H. Wilkerson in Chicago and the case was set for trial on September 18.

A Rival to Lightning Currents



Demonstrating the use of high-magnitude impulse current discharges at the high-voltage laboratory of the General Electric Company in Pittsfield, Mass., this week, a charged capacitor bank gave discharge currents of 250,000 amp. at 150,000 volts in eight microseconds, an energy rate per discharge of 37,500,000 kw.

These large currents were used to volatilize wires, to produce repulsion and attraction effects and to show the pinch effect on conductors of different shapes. The use of the large current impulses and of the customary high-voltage impulses enable experiments to be made that duplicate the effects of lightning.

The capacitor bank consists of 96 "Pyranol"-filled units, each rated 50,000 volts. Three capacitors are in series for 150,000 volts and 32 of these groups are connected in parallel. A generator with two "Kenotron" rectifier tubes in series charges the capacitor bank in about one-half minute.

C.A. McCulloch Sees New Holding Company

Middle West Utilities Company receiver visualizes "an unobjectionable 'New Deal' holding company." Proposes radical departures from accepted conceptions.

In a visualization as startling as it is unconventional, Charles A. McCulloch, receiver of Middle West Utilities Company, last week pictured his ideal of "an unobjectionable 'New Deal' holding company." Based on his experience as receiver for Middle West for the past 27 months, Mr. McCulloch outlines seventeen characteristics which would go to make up his ideal holding company. With the "New Deal" holding company bearing marked resemblance to an investment trust, the elimination of intermediate holding companies, lack of bonds, fixed interest-bearing obligations and fixed dividend preference stocks, profitless servicing of subsidiaries and inclusion of operating executives on holding company boards mark several of the departures from accepted conceptions of the holding company's functions. The salient features of the "New Deal" holding company, as outlined by Mr. McCulloch, are:

1. The holding company should henceforth be viewed as affected by the public interest, with officers, directors and controlling stock interests functioning as trustees, not alone for their security holders but for the public.

2. A simple corporate and financial structure—no bonds or other fixed interest-bearing obligations; no preferred stock with fixed dividend requirements.

3. Abolish intermediate holding companies to obtain 100 per cent ownership of the controlling equity stock in the operating companies.

4. Abolish all mystery as to the relationship between the operating companies and the holding company. Eliminate all secret agreements and expose to the fullest publicity the facts of the new wholesome relationship.

5. All contracts for management or supervision, or involving fees for construction, engineering or financing services should be approved by state commissions having jurisdiction, or the appropriate federal regulatory body if established in the future.

Profitless servicing proposed

6. The holding company should make no profit on services rendered to its subsidiaries. Charges for services should be only such as can be justified

as reasonable. Eliminate all "extra" charges for legal, auditing and other services, so supervision fee covers everything.

7. Prohibit in the company's charter loans or advances to officers, directors or others; also any diversion of funds from the operating company subsidiaries to their parent or affiliated companies. Also abolish the marketing by operating companies of securities of the parent holding company or affiliated companies. Prohibit also by charter the use of funds of any company, holding or operating, for dealing in its own securities or securities of affiliated companies either to support markets or make a profit.

Intercompany profits banned

8. Prohibit profit on intercompany transactions, whether arising from the sale of securities or properties in whole or in part.

9. All contracts in excess of a certain amount to be awarded on a competitive basis after open bidding advertised in advance. No favored contractors or construction company subsidiaries.

10. Adequate provisions for maintenance and retirements to prevent inflation of earnings and excessive payment of dividends.

11. Proposed set-up of any reorganized holding company should have the approval not only of the federal courts having jurisdiction but also of the Federal Trade Commission and the new Securities Exchange Commission.

12. The operating executives of the large companies should be on the board of directors of the holding company, that they may have a hand in the making of policies and the administration of the system as a whole. In this respect the Middle West receivers took the initiative two years ago, which is now being followed by Commonwealth & Southern and other utility and industrial concerns.

13. Full information to stockholders and security holders through annual reports based on audits certified by independent firms of auditors. During the year quarterly reports should go to stockholders covering the operating companies' activities, together with income statements and balance sheets.

14. The holding company, which may be regarded as the proprietor of the utility system, should remain in the background, doing whatever is necessary to watch and protect its investments and helping the operating companies to build themselves up in their respective territories and make their operations more productive.

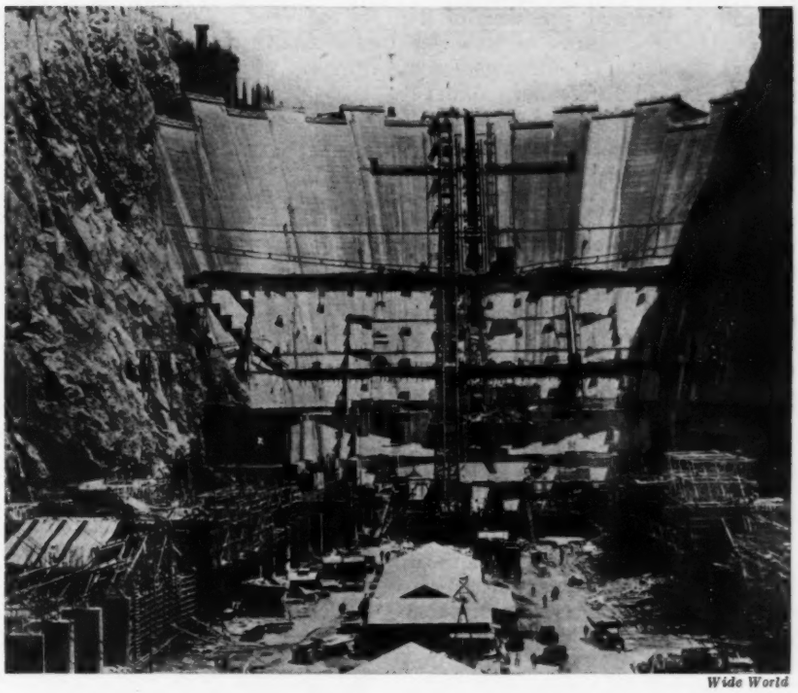
Decentralize operations

15. Holding company operations should, therefore, be more decentralized, with emphasis placed upon the operating companies, which should be provided with executives of outstanding ability. Operations and problems of the utility subsidiaries should be studied on the ground, not in Chicago.

16. A few key men in the Chicago office will be sufficient to exercise the functions of a proprietor, i.e., to establish consistent management and financial policies and to safeguard and improve capital investments. All other activities can more wisely and more advantageously be left to the operating companies themselves.

17. Proceed with the reorganization of such subsidiaries as need and justify such action. Liquidate or otherwise eliminate the non-essential and non-worth-while companies.

JULY AT BOULDER DAM



Wide World

With construction two years ahead of schedule foundation work on the power stations for Boulder Dam keeps pace with the swift-rising crest of the dam itself. Here is the project at the early July stage. Power station construction may be seen at the base of the canyon to right and left.

Blue Eagle to Return to Milwaukee Utility

As an aftermath of the recent strike of Milwaukee Electric Railway & Light Company, which resulted last week in a victory for union labor, NRA Administrator General Johnson has agreed to return the company's Blue Eagle, revoked June 8. The company will sign the transit code, G. W. Van Derzee, vice-president and general manager, stated. The company has already restored twelve of the thirteen previously dismissed union employees to the payroll, fulfilling one of the points specified in the strike settlement.

Appraisal of New Deal to Be Made by Engineers

Plans for a nine-day midsummer conference of engineers on problems related to industrial recovery and reconstruction have just been announced by President Harvey N. Davis of Stevens Institute of Technology. The sessions of the fourth annual Economic Conference of Engineers will begin August 11 and continue through August 19, during which period there will be 25 scheduled meetings, having as their general theme "An Economic Appraisal of the New Deal." As in previous years, the conference will be held at the Stevens Engineering Camp at Johnsonburg, in northern New Jersey.

Educational institutions and engineering organizations which have participated in these conferences include Brown, Columbia, Cornell, Harvard, Massachusetts Institute of Technology, Princeton, Rensselaer, Stevens and Yale, the American Society of Mechanical Engineers, the American Institute of Chemical Engineers and the American Association for Adult Education.

Executive officers of industrial corporations, members of the faculties of economics in several universities and officers of some of the federal agencies of recovery and reconstruction compose the list of visiting lecturers and conference leaders. At the final session of

the conference Gen. Hugh S. Johnson, NRA Administrator, will speak.

Chester I. Barnard, president of the Bell Telephone Company of New Jersey, will speak on "Collectivism and Individualism in Industrial Management"; Prof. Carroll R. Daugherty of the University of Pittsburgh, on "Labor under the NRA Codes"; Henry R. Hayes, formerly president of the Investment Bankers Association of America, on "Some Aspects of Utility Investments"; Leon B. Lent, executive officer of the Code Authority of the Scientific Apparatus Industry, on "Industry Planning under NRA," and Warren M. Persons, consulting economist, on "Government Experimentation in Business, 1776 to 1933."

•

Utilities Commissioners of New England Meet

Recent Supreme Court decisions in utility cases show a trend toward restoration of the wide discretion of public utilities commissions in determining reasonable rates, Attorney John L. Collins, counsel for the Connecticut Public Utilities Commission, told the annual meeting of the New England Association of Utilities Commissioners held at Hartford, Conn., recently.

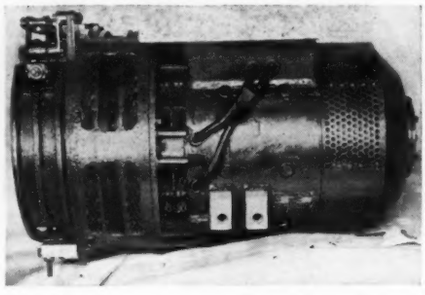
Discussions at the meeting were held by Commissioners Albert J. Stearns of Maine, Stephen S. Cushing of Vermont and Nelson Lee Smith of New Hampshire, following which members of the Connecticut commission's staff presented papers on various subjects. Chief Engineer E. Irvine Rudd discussed the "Comparison of the Alabama Intermediate and Inducement Rate with a Low Rate in Connecticut" and "Supervision of Meter Accuracy" was discussed by Russell G. Warner, electrical engineer for the commission. Chairman Cushing of the Vermont commission was named president of the association for the coming year. The next annual meeting will be held at Montpelier, Vt.

•

Articulated "L" Car Featured by Braking

Brooklyn's stainless steel unit will be delivered this month. Eddy-current braked rapid transit traction units introduced.

Combined traction motors and braking mechanisms in one unit are the chief feature of the second of the experimental multi-section cars fabricated for tests on the "L" lines of the Brooklyn-Manhattan Transit Corporation (ELECTRICAL WORLD, June 23, 1934, page 925). The general characteristics of the two units are the same, but in detail they differ. This most recent unit was constructed of 18-8 stainless steel, shot-welded, by the E. G. Budd Manufacturing Company, with brake and important electrical equipment by General Electric, and will be delivered in the latter part of July. The car has a seating capacity of 170 and total passenger accommodation of 640. Its weight is 159,900 lb., or approximately 4 tons less than the first unit. Both have centralized cab control of motor power, braking, heating and ventilating, lighting, destination signs and signal system.



Traction motor and braking unit introduced on second "L" car

Twelve 300/600-volt high-speed traction motors of 70 hp. each are employed on the six trucks, as in the case of the previously described Westinghouse-equipped car. However, for the first time traction units of the type illustrated are used with combined eddy current braking and air braking on the motor shaft. Normal braking down to 5 m.p.h. is accomplished by a disk on the motor shaft which rotates in a variable field energized from third rail. At that speed eddy current braking fades out and the electro-pneumatic air brake applied to the motor shaft by molded lining shoes is cut in by the 3-m.p.h.p.s. uniform deceleration controller. These G. E. traction units permit a maximum acceleration of 5 m.p.h.p.s. and give a normal acceleration of 3 m.p.h.p.s. The motor-operated controller mechanism permits the selection of two accelerating speeds. Series and series-parallel connection of motors are used with a total of 254 full field and 38 shunted field accelerating stops.

•

National Electrical Show Dates Set for Sept. 19-29

More than fifty electrical manufacturers have arranged to exhibit at the National Electrical Exposition, to be held September 19-29 at Madison Square Garden in New York. The exposition is sponsored by the Electrical Association of New York.

COMING MEETINGS

National Electrical Credit Association—Annual meeting, Chicago, July 19-20 Frederick A. Lind, 1010 Marquette Bldg., Chicago.

Economic Conference of Engineers—Fourth annual meeting, Stevens Institute of Technology Engineering Camp, Johnsonburg, N. J., August 11-19. Harvey N. Davis, Stevens Institute of Technology, Hoboken, N. J.

International Association of Municipal Electricians—Wardman Park Hotel, Washington, D. C., August 29-Sept. 1. W. H. Harth, City Hall, Columbia, S. C.

Producers and Distributors of Electrical Energy—Fifth International Congress, Zurich and Lausanne, Switzerland, August 29-Sept. 7. Secretary, Union des Centrales Suisses d'Electricite, 301 Seefeldstrasse, Zurich.

American Institute of Electrical Engineers—Pacific Coast Convention, Salt Lake City, Utah, September 3-7. General Convention Committee, 1016 Continental Bank Bldg., Salt Lake City, Utah.

National Electrical Exposition— Madison Square Garden, New York, N. Y., September 19-29. Ralph Neumuller, Electrical Association of New York, Grand Central Palace, New York.

. . . THIS WEEK IN WASHINGTON

Manly denies rate survey is designed as lever to force rate reductions . . . General power survey field work starts . . . Power code now in hands of Federal Trade Commission, to return soon to NRA.

VIGOROUS denial of published articles to the effect that the national survey of electric rates is to be used by the Federal Power Commission to influence rate reductions was made on behalf of the commission by Vice-Chairman Basil Manly in a statement to this writer. Mr. Manly said: "The intent of congress and the objective of this commission is to secure complete nation-wide data so that a sound, scientific basis for comparison of rates may be possible. The survey will make these data available for the first time. The commission is not charged with the duty of inquiring into the reasonableness of rates. That is the function of the state commission. Inferences of certain published reports are without foundation."

•

With the advent of the new fiscal year the Federal Power Commission launched its general power survey on a broad front. Sufficient office work has been completed to send out a strong field force to make actual studies of power sites and power requirements. Careful attention is to be given that part of the inquiry which will estimate probable future demands of every important industry in the country.

•

The electric light and power code is still in the hands of the Federal Trade Commission, which is expected to return it in the near future to the National Recovery Administration with extended comment.

PAUL WOOTON,
Washington Correspondent.

Output Resists Spring Decline

Geological Survey report for May shows better than usual production of 7,672,797,000 kw.-hr. Drought effect shows in water-power output.

Production of 7,672,797,000 kw.-hr. by public utility plants during May, according to the U. S. Geological Survey, shows that operations have been holding up better than is usual at this season. It exceeded last year's May by 9 per cent. Average daily output was almost equal to that of April, whereas the normal change is a decrease of 1.3 per cent. It was less than 2 per cent smaller than in February, against a normal 4 per cent, based on fourteen years of records.

The usual seasonal decrease in production from water power began in May with a marked drop due to the effects of drought in various parts of the country. The total from this source was 3,211,369,000 kw.-hr., or 42 per cent of the entire production, against 3,487,656,000 kw.-hr. in April, when it was 47 per cent of the whole. Production from fuel rose to 4,461,428,000 kw.-hr. from 3,956,263,000 kw.-hr. in April, with a corresponding increase in fuel consumption.

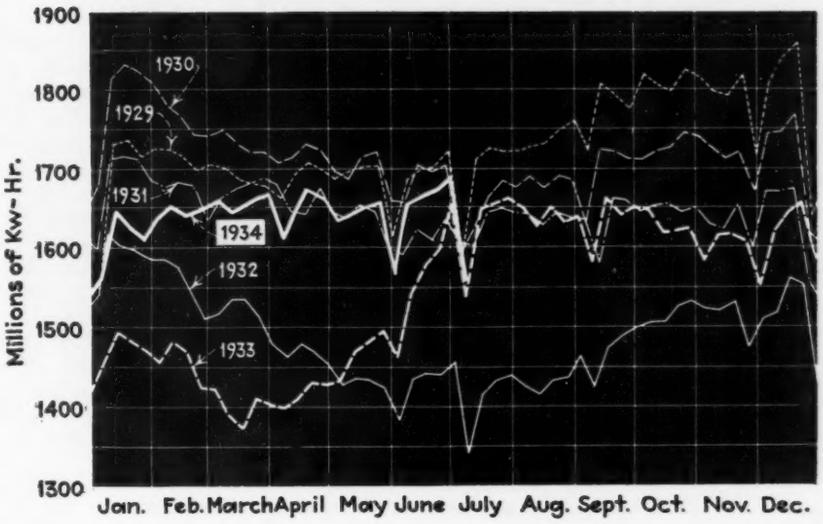
The returns include railway and other public utility plants in addition to those for light and power.

Regional changes, in per cent, compared with 1933 were as follows:

Region	March	April	May
New England	+24	+19	+10
Middle Atlantic	+12	+15	+10
East No. Central ..	+28	+20	+15
West No. Central ..	+ 2	+ 4	+ 1
South Atlantic	+ 9	+ 7	— 6
East So. Central	+23	+33	+19
West So. Central ..	+ 8	+ 8	+ 4
Mountain	+15	+19	+21
Pacific	+10	+13	+14
United States	+15	+15	+ 9

•

Holiday Cuts Energy Output



Responding as usual to the interruption of work caused by the holiday, output of electrical energy during the week ended July 7 fell off sharply to 1,555,844,000 kw.-hr., according to the Edison Electric Institute. The decline from the preceding week was greater than in other recent years, but there remains a gain of 1.1 per cent over 1933 and the disparity compared with 1929 and 1930 continues small, being still around 2 per cent.

Divergent movements appear in the different regions. New England, which two months ago was 13 per cent ahead of 1933, is now 11.3 per cent behind. In contrast, on the Pacific coast the lead has been increasing and is now 11.9 per cent. In the Middle Atlantic states fluctuations have been moderate. The latest figure, 5.8 per cent, is rather better than the preceding month's average, whereas in the Central and West Central areas the excess over 1933 has during the same period been steadily shrinking. In making these comparisons last year's rapid rise must not be overlooked.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
July 7...1,556	July 8...1,539	July 9...1,342
June 30...1,688	July 1...1,656	July 2...1,457
June 23...1,675	June 24...1,598	June 25...1,441
June 16...1,665	June 17...1,578	June 18...1,442
June 9...1,655	June 10...1,542	June 11...1,435

Per Cent Change from Previous Year

Region	Week ended July 7	June 30	June 23
New England.....	—11.3	— 6.7	—4.9
Middle Atlantic....	+ 5.8	+ 2.7	+6.6
Central Industrial..	— 0.3	+ 2.6	+5.7
West Central.....	+ 1.6	+ 5.3	+7.4
Southern States ...	— 4.2	+ 1.9	+4.3
Rocky Mountain...	+ 1.7	+ 1.5	—0.3
Pacific Coast.....	+11.9	+11.1	+9.8
United States.....	+ 1.1	+ 2.0	+4.8

Reconstruction Advancing at Connors Creek Station

Partial rehabilitation of the Connors Creek station of the Detroit Edison Company (ELECTRICAL WORLD, October 28, 1933, pages 570 and 571) is well advanced, according to recent reports. The plans primarily call for the installation of two new boilers which are a modification of the old type W Stirling boilers replaced and the installation of two rebuilt 30,000-kw. turbo-generators in place of two 20,000-kw. units. Three times as much steam will be generated by the new boilers occupying the same floor space and the efficiency, it is said, will be 86 instead of 79 per cent (coal to turbine). This result is accomplished by operating with compensating superheater, twin economizer, preheater, water-cooled walls and by improvements in coal burning such as in the control of air and use of higher stoker speeds. The operating pressure of 600 lb. per square inch and temperature of 825 deg. F. represents also about the highest used in turbines operating on the simple regenerative cycle in commercial use in this country.

Erection work is now going ahead on the first of the two rebuilt 30,000-kw. high-pressure turbines to be known as unit No. 8. Mud drums have been placed and the installation of tubes for high-pressure boiler No. 1 completed. Installation of boiler feed, main steam, condensate and safety valve vent piping and ceramic work is also well advanced on this unit. Erection of supporting steelwork for new boiler No. 2 has been completed and the drums placed. Stair and walkways for both units have just been finished. Three maintenance shops in the coal unloading house are ready for occupancy and the new d.c. house service bus in the condenser room and the aluminum d.c. ring bus are also completed. The work of building the steel housing for the 12,000-volt bus between No. 8 unit and the transformer and of removing the monitor extending the length of the turbine room is in progress.

•

Germany Bans Copper Cable

Following the recently promulgated Nazi regulation prohibiting the use of copper in high-tension cables, an increasing use of aluminum at the expense of copper in the electrical industry is becoming noticeable. Under the regulation, unless special permission is granted by the state Metal Supervision Office, any cables erected must henceforth be made of aluminum. The reason for the restriction is said to be that the cost of the imported bauxite used as raw material is only 1 per cent of the cost of the finished metal.

As to Rates . . .

• Georgia Power & Light Company has been ordered by the state Public Service Commission to reduce its annual charges approximately $80,463. Several months ago the commission ordered the company to reduce its rates, but the company obtained a federal court order restraining the commission from putting the order into effect. Employing the same method used in the cases of telephone companies, the commission then withdrew the previous orders and held a series of new hearings, at which the power and light company declined to present additional evidence. The second rate reduction order was issued last week. The reduction affects 30 cities and towns in south Georgia.

• Kansas Power & Light Company has been authorized by the state Corporation Commission to reduce its minimum monthly charge to rural customers to $3 for all who have 5-kva. transformers. The present charge is graduated upward from $3 for a 3-kva. transformer.

• Kansas Gas & Electric Company has been authorized to reduce the first step in its rates to 4 cents for the first 50 kw.-hr. of monthly consumption. The rates previously were 4 cents for the first 30 kw.-hr.

• Western United Gas & Electric Company has been ordered by the Illinois Commerce Commission to reduce its electric rates in the amount of $325,000. Residential customers will receive the major portion of the reduction. Of the $325,000, approximately $240,000 will go to residential customers, $60,000 to commercial customers and $25,000 to large light and power users. More than 35,000 customers will benefit by the reduction, the order affecting customers in the northern division of the company only, in which there are more than 90 per cent of its electric users. The southern division obtained reductions last year. B. F. Lindheimer, chairman of the commission, said that the new rates were effective as of August 1, since the company had agreed not to contest the order in the courts.

• Public Service Electric & Gas Company's witness, James A. Emery, who is senior vice-president of Ford, Bacon & Davis of New York, at a recent hearing, testified the fair present-day value for rate-making purposes of the electric department of the company is not less than $445,509,070 as of December 31, 1932. Dr. John L. Bauer, rate expert for proponents of a rate reduction, had testified that in his opinion a proper rate base would be $150,000,000. A historical cost study made by Major Edward J. Barry, appraisal engineer for the commission, indicated an actual cost of $282,011,862. Major Barry deducted the amount in the depreciation reserve of the department, $43,263,700, as accrued appreciation, leaving an investment value of $242,969,114. To the historical cost figure nothing was added for "going concern" value or working capital. The witness for the company, Mr. Emery, estimated the department's going concern or intangible value was not less than $65,000,000. A wide difference was evident in estimates of depreciation of the property. To support his "going concern" value Mr. Emery submitted the result of elaborate studies concerning elements of value created over and above mere physical value. He included elements resulting from consolidations, from the training of the employees, from developing the business to its present state and the development of public relations.

• Public Service Company of Oklahoma has been requested by the state Corporation Commission to make an immediate reduction of electric rates in 64 towns of eastern Oklahoma. Commissioners J. C. Walton and E. R. Hughes directed the company to make an immediate reduction or show cause why it has not done so. Tulsa, the largest city served by the company, was not included in the order.

• Public Service Company of Indiana electric charges to residential and commercial customers in Princeton have been lowered approximately 8 per cent under new schedules which were effective June 27.

•

Middlesboro Officials Held in Contempt of Court

City officials of Middlesboro were held in contempt of court last week and fined $10 for alleged violation of the injunction of the Court of Appeals in connection with the proposed sale of bonds for a municipal power plant. The officials, Mayor Ike Ginsburg and Commissioners H. B. Stallard and John Burch, announced they would appeal.

The Court of Appeals earlier in the month ruled that Middlesboro could not accept a loan of $328,000 from the Public Works Administration for a power plant without submitting the question to a vote of the people. The ordinance under which they were enjoined was then repealed by the commissioners and a new ordinance passed. It was on this action that the Kentucky Utilities Company, now furnishing power to Middlesboro, brought contempt proceedings.

The company, which turned off the street lights recently in an attempt to force payment of a bill allegedly due from the city, turned the street lights on again last week, and informed the city officials it would demand payment in advance in the future.

Piedmont Towns Plan $6,500,000 Plant

Plans for a $6,500,000 electric light and power plant, linking twelve to fifteen Piedmont, North Carolina, towns, cooperatively controlled by the towns and financed by the federal government, were revealed last week by City Attorney W. H. Childs of Lincolnton. The towns to be served by the project and which are lending their support, Mr. Childs said, are Lincolnton, Shelby, Kings Mountain, Cherryville, Forest City, Rutherfordton, Maiden, Newton, Hickory, Morganton, Granite Falls and Lenoir, in addition to various other smaller communities.

Application for a P.W.A. loan to put through the project is in preparation. A charter for the corporation has already been issued by the state government. The company is called the Piedmont Municipal Electric Company.

•

Camden Gets Tentative Loan

Allotment of $6,000,000 as a loan and grant to Camden, N. J., for the construction of a municipal electric light system and power plant, provided the New Jersey Legislature enacts certain enabling legislation, has been announced by Public Works Administrator Harold L. Ickes. The next step is up to Camden and the state Legislature. If at its present session the Legislature does not enact the necessary legislation P.W.A. will withdraw the allotment and allocate the funds elsewhere.

The tentative allotment was made by Administrator Ickes on recommendation of the P.W.A. Electric Power Board of Review after the administrator had written to Governor Moore of New Jersey advising him of the legal barriers to Camden's application (ELECTRICAL WORLD, July 7, page 28.) The administrator offered for the Governor's consideration three bills, enactment of which would pave the way for favorable action by P.W.A. on the city's request for a federal loan and grant.

•

P.W.A. Loan Revision Sought

Greenwood County, South Carolina, notified the P.W.A. power review board that it would revise its application for a $2,767,000 allotment to construct a municipal power plant. Approval of the Greenwood allotment was protested by the Duke Foundation (ELECTRICAL WORLD, July 7, page 25). Decision of the county to revise its application was conveyed to the board by D. T. Duncan, engineer for the proposed hydro-electric plant on the Saluda River. The modification contemplated was not disclosed.

FINANCIAL · · · BUSINESS

United Corporation Drops Utility Men

Restricts directorate to bankers. Bank loans liquidated. Extension of security holdings to other fields predicted.

Reversing the recent developments in the Niagara Hudson Power Corporation and the Commonwealth & Southern Corporation, two of its principal affiliates (ELECTRICAL WORLD, June 23, pages 927 and 930), the United Corporation of Delaware took the first steps this week in carrying out a plan to have a board of directors composed exclusively of bankers rather than utility executives. Announcement was also made that the corporation had liquidated the remainder of its bank loans.

New banker board

The directors who resigned at the meeting held last Tuesday were Philip G. Gossler, president of the Columbia Gas & Electric Corporation; Thomas N. McCarter, president of the Public Service Corporation of New Jersey, and John E. Zimmermann, president of the United Gas Improvement Company. The board now comprises Floyd L. Carlisle, president of F. L. Carlisle & Company; Edward Hopkinson, Jr., of Drexel & Company; Alfred L Loomis and Landon K. Thorne of Thorne, Loomis & Company, formerly heads of Bonbright & Company; George H. Howard, president of the United Corporation, and Harold Stanley and George Whitney of J. P. Morgan & Company.

It is believed that elimination of its bank loans and restriction of its board of directors to bankers indicate that the United Corporation will resume its investment activities in the near future. It is further concluded that this activity will not be limited necessarily to the acquiring of public utility securities, but that under its broad charter the corporation will extend its acquisitions of securities to other fields. Having eliminated bank loans, the company will be able to assemble large sums of cash for use in making additional investments.

Bank loans of the corporation reached a maximum of $15,000,000 in 1930 and were reduced to $12,588,473 at the end of 1931, to $11,672,000 at the end of 1932 and to $5,000,000 at the end of 1933. The greater part of them was eliminated out of earnings, but certain minor investments, principally preferred stocks, were sold last year and early this year. In the report for the second quarter of 1934, just issued, the United Corporation announced net income of $2,534,614 after all deductions, comparing with $2,540,047 in the first quarter and with $2,668,885 in the second quarter of 1933. Surplus after preferred dividends was $668,099, equal to 4.6 cents a share earned on 14,529,492 common shares, against 5 cents a share in the first quarter and 6 cents a share in the second quarter of 1933.

•

Nikola Tesla Invents Electrical "Death Beam"

The 78-year-old pioneer and inventor, Nikola Tesla, announced this week some new inventions and ideas, chief among the inventions being an electrical projection beam of energy carrying minute physical particles at high velocity. With these beams he claims armies and airplanes can be shot down at distances up to 200 miles. These beams can also be used to transmit wireless power in quantity in peace time. Dr. Tesla refused to state the principles used or to describe the equipment, but said these would be made public shortly. The four parts of his plan consist of a generating plant to make waves in air, an apparatus to produce and control large currents, an amplifying device to raise the potential to, say, 50,000,000 volts or more, and a method to get the repelling rays into action through the atmosphere. Minute physical particles rather than atoms can be sent out over the pencil beams to create the destruction desired in war, Dr. Tesla asserted.

In addition he stated that he had invented new instruments that showed the sun and other stars were accumulating energy and that he was approaching a solution to the problem of tapping the unlimited quantities of energy found in the universe.

•

Columbia Gas & Electric Omits Common Dividend

Columbia Gas & Electric Company omitted this week the dividend of 12½ cents a share on the common stock due at this time, but declared regular quarterly dividends on all preferred and preference stocks. The last common dividend was 12½ cents a share in 5 per cent convertible preference stock, or 1/800th of a share of preference stock, paid on May 15. After the directors' meeting the following statement was issued: "As a result of reductions in rates for services inaugurated by various municipalities which involve serious curtailment of both gross and net earnings, and because of continuing increases in taxes and costs of operations, no dividend was declared on the common stock at this time, the board deeming it best further to strengthen the corporation's cash position.

•

General Electric Orders Up 52 per Cent

Orders received by the General Electric Company for the second quarter of 1934 amounted to $54,005,988, compared with $35,539,858 for the second quarter of 1933, an increase of 52 per cent, President Gerard Swope announced this week. The second quarter of 1934 was the largest since the third quarter of 1931.

Orders received for six months amounted to $92,154,642, compared with $61,051,502 for six months last year, an increase of 51 per cent.

•

Receiver for Iowa Utility

On petition of Joseph Morrow, a preferred-stock holder, asking that the Sioux City Gas & Electric Comany be enjoined from paying additional fees to the Iowa Public Service Company and the American Electric Power Corporation, holders of the common stock of the Sioux City utility, W. F. Bertke has been appointed temporary receiver by District Judge F. H. Rice. At the hearing George A. Neal, vice-president and general manager of the Sioux City company, pointed out that the American Electric Power is already in receivership.

REASSURANCE

Approaching the critical uncertainties of midsummer, current indices of business volumes, almost unanimously reassuring, seem to confute the bearish prognostications of those who forecast a summer slump. Reflecting the holiday hiatus, energy output showed its expected decline for the week. Steel, following a fortnight of precipitate drops, demonstrated recuperative powers this week as current rate of output rose to 27½ per cent of capacity. Carloadings reached to a new high for the year, indicating sustained movement of goods into retail markets. Once again bituminous coal production gained. Only automobile production failed to keep pace with its recent high levels, sinking to a point more than 10,000 units below the same week last year. Led by cotton and the grains, commodities continued their upward trends, while security prices improved in a more active market.

American Radiator Forms Air-Conditioning Unit

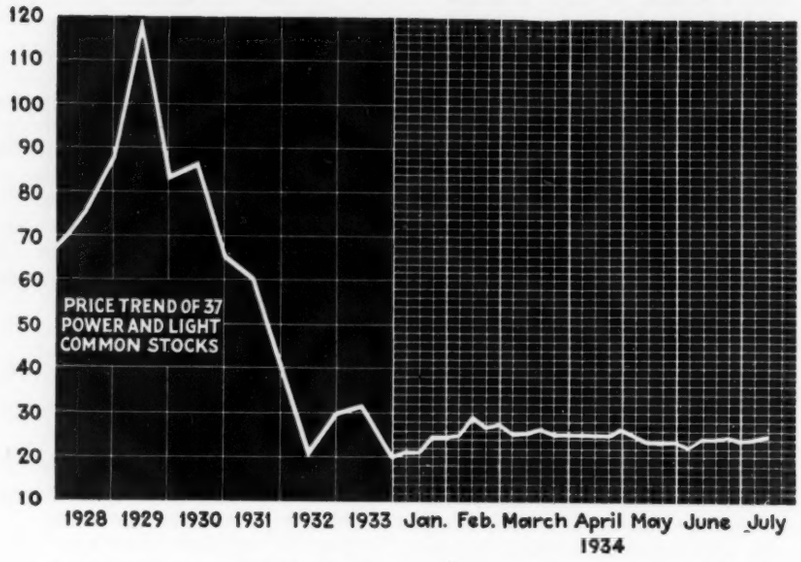
Standard Air Conditioning, Inc., a company to deal exclusively in air-conditioning equipment, has been formed by the American Radiator & Standard Sanitary Corporation. The company has taken over the air-conditioning activities of the Campbell Metal Window Corporation, an affiliate of the American Radiator & Standard Sanitary, and will begin immediately to market air-conditioning appliances for use with radiator heating systems.

•

Laclede Suit Dismissed

Receivership suit brought by Joseph W. Zeller, a bondholder, against Laclede Gas Light Company was dismissed last week by Federal Judge Faris in St. Louis. At the hearing Fred Fairbanks, vice-president and trust officer of Boatmen's National Bank, St. Louis, testified that deposits of the company's bonds under the extension plan and agreement totaled $5,697,000 as of July 2, 1934. Mr. Zeller's counsel sought to show that 80 per cent of the bonds, of which $10,000,000 matured April 1, had been deposited on April 28, just prior to filing of the receivership suit. The 80 per cent figure was based on press reports.

Utility Stocks Show Strength



Stock prices of electric light and power companies, in common with the general market, advanced steadily. *Electrical World* index, 24.5; last week 24.2.

Midland Trustees Named

Hugh M. Morris of Wilmington and John N. Shannahan of Indianapolis were appointed trustees for Midland Utilities and Midland United companies in Wilmington, Del., by Judge John P. Nields in United States District Court. More than two-thirds of the Gary Electric & Gas Company bonds have been deposited under the extension plan of the company. A total of $5,336,000 par amount have been deposited out of the $8,000,000 issue. This company,

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
Alabama Power (Year ended May 31)					
Gross earnings	$15,675,750	$15,161,694	3.4	50	48
Net earnings	7,771,576	7,833,730	— 0.8		
Net balance	724,802	849,615	— 14.7		
Carolina Power & Light (Year ended May 31)					
Gross earnings	9,542,780	8,711,348	10.0	61	62
Net earnings	3,746,183	3,273,338	14.4		
Net balance	67,458*	513,658*	87.0		
Consumers Power (Year ended May 31)					
Gross earnings	26,965,281	26,270,843	2.6	56	54
Net earnings	11,952,889	12,100,830	— 1.2		
Net balance	3,258,088	3,328,441	— 2.1		
Kansas City Power & Light (Year ended May 31)					
Gross earnings	14,433,800	14,443,337	— 0.0	64	63
Net earnings	5,169,916	5,422,616	— 4.6		
Net balance†	3,274,454	3,554,167	— 7.8		
Montana Power (Year ended May 31)					
Gross earnings	9,026,392	8,163,246	1.0	57	53
Net earnings	3,827,709	3,843,198	— 0.4		
Net balance	400,919	618,867	— 35.1		
New Orleans Public Service (Year ended May 31)					
Gross earnings	14,977,562	15,099,773	— 1.0	78	75
Net earnings	3,322,587	3,814,948	— 12.9		
Net balance	120,438*	331,860	—136.0		
Pennsylvania Power & Light (Year ended May 31)					
Gross earnings	33,514,372	32,606,243	2.8	55	53
Net earnings	15,122,832	15,377,400	— 1.6		
Net balance	5,480,273	5,783,662	— 5.2		
Tennessee Electric Power (Year ended May 31)					
Gross earnings	11,948,194	11,190,192	6.8	61	58
Net earnings	4,664,069	4,718,468	— 1.1		
Net balance	471,721	502,634	— 6.1		
Utah Power & Light (Year ended May 31)					
Gross earnings	9,559,716	9,932,490	— 4.0	63	57
Net earnings	3,560,401	4,328,366	— 17.7		
Net balance	1,150,020*	433,267*	—165.0		

Holding Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
AmericanGas & Electric and subsidiaries (Year ended May 31)					
Gross earnings	$65,872,698	$62,316,374	5.7	61	59
Net balance	7,874,861	7,798,540	0.9		
American Power & Light and subsidiaries					
Gross earnings	73,888,127	73,238,043	0.8	58	55
Net balance	3,555,476	6,308,832	— 43.6		
American Water Works & Electric and subsidiaries (Year ended May 31)					
Gross earnings	44,655,299	41,434,858	7.7	56	55
Net balance	2,504,852	1,650,869	51.7		
Commonwealth & Southern and subsidiaries (Year ended May 31)					
Gross earnings	112,507,712	108,724,505	3.5	56	55
Net balance	305,067	340,258	— 10.3		
Electric Power & Light and subsidiaries (Year ended May 31)					
Gross earnings	70,437,087	70,267,472	0.2	65	61
Net balance	1,100,471*	1,447,006	176.0		
Engineers Public Service and constituent Cos. (Year ended May 31)					
Gross earnings	42,953,328	43,825,932	— 1.9	59	57
Net balance	1,464,905*	839,336	—275.0		
National Power & Light and subsidiaries (Year ended May 31)					
Gross earnings	70,258,148	68,542,017	2.5	61	60
Net balance	6,861,336	7,385,292	— 7.1		
Public Service Corporation of N. J. and subsidiaries (Year ended May 31)					
Gross earnings	118,706,264	119,736,757	— 0.9	....	....
Net balance†	26,171,901	26,768,193	— 2.2		

*Deficit. †Available for all dividends.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

which is one unit in the Midland United System, also is seeking a reorganization under the amended bankruptcy laws.

•

Box Board Mill Electrifies to Save $45,000 Annually

Estimating annual savings of $45,000, the American Box Board Company will electrify one of its mills at Grand Rapids, Mich., the Westinghouse Electric & Manufacturing Company states in announcing the receipt of an order for approximately $120,000 for electrical equipment from that company. The new equipment consists of a 3,000-kw. condensing bleeder type turbo-generator unit, 1,950-sq.ft. condenser, single-motor paper machine drive equipment, a 100-hp. squirrel-cage motor with V-belt drive, four 100-hp. gear motors for driving Jordans and five 60-hp. gearmotors for driving beaters.

The new equipment replaces four small turbines and three steam engines with a new 3,000-kw. unit. Through the installation of high-speed squirrel-cage gearmotors rather than low-speed slip-ring motors the plant power factor will be maintained at higher than 80 per cent. The plant is planned to be in operation by September 4, and it is expected that savings will liquidate equipment cost in three years.

•

Delta-Star to Make Oil-Blast Breakers

Delta-Star Electric Company, Chicago, has been granted a patent license by the General Electric Company to manufacture oil-blast oil circuit breakers, the former company announced this week. Delta-Star will also use the high-capacity testing laboratory of the General Electric Company to conduct tests on these new oil-blast designs.

•

Leonard Shipments Rise

More electric refrigerators were shipped by Leonard Refrigerator Company in the nine months ended June 30 than in any full year in the company's history, the company reported this week. Shipments for 1933, previous high record year, have already been exceeded by 6,000 units, the company states.

New York Metal Prices

	July 3, 1934 Cents per Pound	July 10, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. price	3.75	3.75
Antimony	7.775	7.75
Nickel ingot	35.00	35.00
Zinc, spot	4.70	4.70
Tin Straits	51.25	51.80
Aluminum, 99 per cent.	23.30	23.30

*Blue Eagle

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Millinocket, Me.—Great Northern Paper Company has plans for new hydro-electric power plant for mill service. H. J. Deutschbein Company, 350 Fifth Avenue, New York, N. Y., is engineer.

Kansas City, Mo.—United States Engineer Office asks bids until July 19 for twelve portable cable terminal structures, with spare jumper cables, etc., and four sets live line equipment (Circular 191).

Readlyn, Iowa—Asks bids until July 17 for equipment for city-owned electrical distribution system and about 6 miles of 13,200-volt transmission line for power supply.

Newark, N. J.—Bendix Aviation Corporation, Chicago, Ill., and affiliated interests plan installation of motors and controls, regulators, conveyors and other equipment in proposed new multi-unit plant at Port Newark. Cost over $700,000. Frank Grad, Newark, architect.

Osceola, Ark.—Plans purchase of Diesel engine-generator unit and accessory equipment for city-owned electric light and power plant. Fund of $52,000 is being arranged.

Cincinnati, Ohio—Kroger Grocery & Baking Company plans installation of motors and controls, conveyors, hoists, etc., in new multi-story meat-packing plant, for which bids will be asked before close of month. A $500,000 project. Tietig & Lee, Cincinnati, architects.

Portland, Ore.—United States Engineer Office asks bids until July 18 for two hydraulic turbines with governor adjusted blades, two control gates and stems, breaking elements for gate-operating mechanism, runner blade, etc. (Circular 804).

Detroit, Mich.—American Malting Company, Dime Bank Building, recently organized, plans power plant at new multi-story malt factory, where motors and controls, hoists, conveyors and other equipment will be installed. Cost about $700,000.

Detroit, Mich.—Great Lakes Steel Corporation, Ecorse, Detroit, a subsidiary of National Steel Corporation, Pittsburgh, Pa., plans installation of heavy-duty motors and controls, regulators, motor-generator sets and auxiliary units, electric hoists and other equipment in proposed new continuous hot and cold strip mill. A $10,000,000 project.

New York, N. Y.—Board of Transportation, 250 Hudson Street, asks bids until July 20 for insulators, track rails and other track materials for new subway lines and for new car inspection shop and service buildings at car yards of Queens-Jamaica system, Jamaica, L. I.; until July 24 for power equipment for Houston, Essex, Rutgers Street line, Manhattan. (This is part of subway program for which city has secured $23,160,000 through federal aid.)

Knoxville, Tenn.—Director of Purchases, Tennessee Valley Authority, asks bids until July 19 for power transformers and accessories (postponed from July 9).

Chicago, Ill.—Paul Gerhardt, Sr., 64 West Randolph Street, architect, has plans nearing completion for three new distilling plants, two to be located in Illinois and one in Kentucky, for company whose name is temporarily withheld. Cost over $400,000.

Los Angeles, Calif.—Hughes-Mitchell Processes, Inc., 618 Majestic Building, Denver, Colo., plans installation of motors and controls, conveyors and other equipment in new chemical plant at Torrance, Los Angeles. Cost about $85,000.

San Antonio, Tex.—Colorado River Company, Austin, headed by R. W. Morrison, Austin, and associates, plans hydroelectric generating plant in connection with new Hamilton dam to be constructed on Colorado River, near Austin. It will be equipped for initial capacity of 20,000 kw.; project will include power substation and transmission line. Fund of $4,500,000 has been secured through federal aid.

Detroit, Mich.—Ziegler-Hutter Breweries, Inc., 1227 Detroit Savings Bank Building, recently organized, plans new multi-story plant. Cost about $100,000.

Noyes, Minn.—Custodian, United States Inspection Station, asks bids until July 21 for floodlighting system.

Wyandotte, Mich.—Michigan Alkali Company plans installation of motors and controls, conveyors, loaders, etc., in proposed new plant addition. Cost over $500,000.

Cedar Rapids, Iowa—Has authorized plans for installation of ornamental street-lighting system on portion of First Street. F. E. Young, city engineer, in charge.

Riverside, Calif.—Board of County Supervisors has instructed County Purchasing Agent to secure estimates of cost for new electric generating plant at county hospital.

Richmond, Va.—Virginia Airship Company, Inc., plans installation of motors and controls, conveyors, electric hoists, transformers and accessories and other equipment in new multi-unit aircraft and airplane engine manufacturing plant on site near Byrd Airport. Cost over $600,000.

Sumas, Wash.—Custodian, United States Inspection Station, asks bids until July 25 for floodlighting system.

Indianapolis, Ind.—F-K Auto Trunk Company, 2122 Northwestern Avenue, plans installation of motors and controls, conveyors, etc., for proposed rebuilding of portion of plant recently destroyed by fire. Loss about $50,000.

Dayton, Ohio—Contracting Officer, Material Division, Air Corps, Wright Field, asks bids until July 27 for 250,000 ft. high-tension ignition cable and 125 reels (Circular 641).

MEN OF THE INDUSTRY

R. M. Houger Heads North Central Association

R. M. Houger, vice-president and general manager of the Eastern Minnesota Power Company, Pine City, and Wisconsin Hydro-Electric Company, Amery, has recently been elected president of the North Central Electric Association. Mr. Houger started in the electric business in 1908 with the Winnipeg Municipal Utility Company. He spent four years as operating superintendent at the Wells, Minn., municipal plant and from 1914 to 1927 he worked with the Commonwealth Utility Company, Mankato, Minn. In 1927 he was vice-president and general manager of the Wisconsin Hydro-Electric Company and in 1928 he was appointed to the same position with the Eastern Minnesota Power Company.

•

A. D. HUNT has been appointed manager of engineering at the South Philadelphia plant of the Westinghouse Electric & Manufacturing Company. He is succeeding John M. Lessells, who resigned to open an office as consulting engineer, specializing in mechanical work.

WILLIAM T. KELLEY has been appointed acting chief counsel of the Federal Trade Commission to take over the work of Robert E. Healy, who resigned to become a member of the Securities and Exchange Commission. Mr. Kelley joined the legal staff of the commission in 1914 and has been assistant chief counsel since 1923.

H. S. VASSAR, laboratory engineer of the Public Service Electric & Gas Company, Irvington, N. J., was recently elected vice-president of the American Society for Testing Materials. Following graduation from Pratt Institute in 1903, he engaged in work in the engineering and operating departments of the company of whose testing laboratory he is now in charge.

E. S. MCCLELLAND has retired from active business after 53 years of continuous service with the Westinghouse Electric & Manufacturing Company. Starting as a helper in the foundry of the Westinghouse Machine Company in 1881, before the founding of the electric company, he advanced to the pattern shop, the production department, drafting department and the engineering department. He became assistant chief engineer, then assistant general superintendent and later works manager. In 1920 he was appointed director of personnel, a position he has since held. Mr. McClelland has been active in the American Society of Mechanical Engineers, American Management Association and the Electrical Manufacturers Council.

•

W. E. Mosher Director of National Rate Survey

Dr. William E. Mosher, who was appointed last week by the Federal Power Commission to direct the electric rate survey authorized by Congress (ELECTRICAL WORLD, July 7, page 24), has had extensive practical experience in governmental investigations. A recognized authority on public utility regulation, he is the author of a book on that subject and collaborated with other scholars in producing "Electrical Utilities, the Crisis in Public Control," published in 1929. In that year he was made director of research of the Joint Legislative Commission investigating the public service commission laws of New York State, under Gov. Franklin D. Roosevelt, generally considered one of the most comprehensive surveys of the policies of public service commissioners ever made in this country.

A native of Syracuse, Dr. Mosher was graduated from Oberlin College, Ohio, in 1899 and afterward pursued special studies in Germany at the universities of Halle and Berlin. Returning to America, he was a member of the faculty of Oberlin until 1918, when he became associated with the Bureau of Municipal Research, New York, a connection he maintained until 1924. Since that time he has been director of the School of Citizenship and Public Affairs at Syracuse and professor of political science.

In 1919-20 he was director of research of the Joint Commission on Reclassification of Salaries, in Washington, and in 1921 made, under the Postmaster-General, a survey of the employment policy of the Post Office Department. From 1922 to 1924 he served on the staff of the New York Legislative Commission on Taxation and Retrenchment, and was also secretary of the committee on civil service of the National Municipality League and Government Research Conference. He is a member of the Political Science Association, the American Economic League, the Government Research Conference and the American Legislators' Association.

•

REFORD BOND of Chickasha, Okla., has been appointed by Gov. William H. Murray chairman of the Oklahoma Corporation Commission, to succeed Paul A. Walker. Mr. Walker was recently appointed a member of the recently formed Federal Communications Commission.

CLIFFORD A. HINDS has been named assistant to the general superintendent of the Sierra Pacific Power Company and will have charge of Reno distribution and power plant operation. Mr. Hinds has been employed by the Sierra Pacific utility since 1919.

W. R. JUDSON has been appointed manager of the Salt Lake City district office of the Allis-Chalmers Manufacturing Company. For the past three years Mr. Judson has been managing director of Allis-Chalmers (France), representing the Allis-Chalmers Manufacturing Company in Europe. Prior to that time he was for thirteen years manager of the company's office at Santiago, Chile, covering Chile, Peru, and Bolivia. In Salt Lake City Mr. Judson is succeeding H. E. WEISS, who has been transferred to the company's office at Kansas City.

PHILIP J. SAVAGE, assistant general manager of the Detroit Edison Company, has been elected a member of the board of directors of the Detroit Board of Commerce.

CHARLES E. WILSON, a vice-president of the General Electric Company, has been elected a director of the Electric Household Utilities Corporation. W. A. RYAN has also been elected to the directorate of Electric Household Utilities. They are succeeding the late A. R. Erskine and the late E. N. Hurley.

A. C. CRANDALL has been made commercial manager of the Atlanta division of the Georgia Power Company. Since last October Mr. Crandall has been engaged in special work for the vice-president in charge of sales. He will have charge of all sales work in Atlanta, including merchandise sales, commercial sales and industrial and commercial lighting.

OBITUARY

Harris J. Ryan

Dr. Harris J. Ryan, internationally known for his research achievements in long-distance power transmission, died, of a heart attack, July 4, in his sixty-ninth year. Three years ago Dr. Ryan relinquished his academic duties as executive head of the electrical engineering department at Stanford University,

California, to devote his entire efforts to electrical research.

His experimental work covered practically the entire field of electrical engineering from the development of direct-current machinery to high-voltage, long-distance transmission. Research directed toward practical ends had been the aim of Dr. Ryan's life. In recognition of the importance and value of the work that he had done, a modern high-tension laboratory was built in 1926 at Stanford, known as the Harris J. Ryan high-voltage laboratory, where he found it possible to cary his researches to a point formerly impossible.

He was recognized as one of the first engineers to use the cathode-ray tube as a valuable piece of apparatus for studying high-voltage effects, and his researches were a factor in the discovery of the laws of corona on high-voltage transmission lines. One of his most outstanding experiments was the production and control of artificial lightning in his laboratory. For his contributions to the science and the art of high-tension transmission of power he was awarded the Edison medal for the year 1925.

Dr. Ryan was born in Powells Valley, Pa., and was graduated in electrical engineering from Cornell University in 1887. He served on the faculty at Ithaca until 1905, when he went to Stanford. Not the least of Dr. Ryan's contributions to the development of electrical science has been the work done by associates and graduate students who have been inspired by his genius and had the inestimable advantage of working under his sympathetic direction. He had served the American Institute of Electrical Engineers as president, vice-president and committee member. He also was a fellow of the American Association for the Advancement of Science and a member of the American Society of Mechanical Engineers and of other associations.

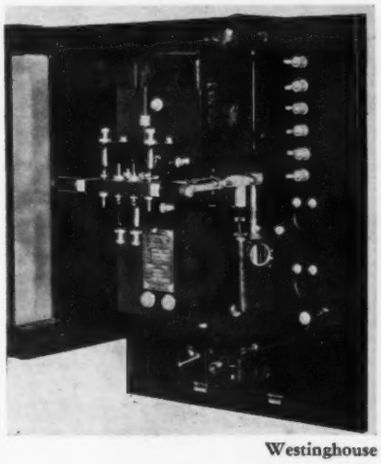
•

Dr. William H. Walker, distinguished chemist, died suddenly July 9 in Seabrook, N. H., as the result of an automobile accident. Dr. Walker's most notable work was done during the World War, when he served as chief of the chemical service section. Born in Pittsburgh in 1869, he was graduated from Pennsylvania State College in 1890. Dr. Walker served for many years as a lecturer and instructor in subjects of chemical engineering at the Massachusetts Institute of Technology and Harvard University. He relinquished his duties at M.I.T. in 1921. Dr. Walker served as president of the American Electrochemical Society in 1910-11 and as president of the Eastern section of the Chemical Society in 1904. He was a fellow of the American Academy of Arts and Sciences and of the American Iron and Steel Institute. He was a frequent contributor on scientific subjects to various journals both in this country and abroad.

NEW EQUIPMENT

Heavy-Duty Regulator for Generators

For use as either an exciter or generator rheostatic regulator, the type PR voltage regulator has been introduced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. The regulator utilizes conventional motor-operated rheostats and contactor panels. The control element was de-



Westinghouse

veloped for marine use, in which conditions of shock and tilt must be met. It employs the dynamic principle similar to that used in dynamic radio speakers. Two sets of contacts, one of which is used to operate the motor-operated rheostat under minor voltage fluctuation and the other which functions under major fluctuations to actuate the contactors which short circuit the resistance of the rheostat, are employed. The element can be operated for controlling either a.c. or d.c. equipment. When used on a.c. systems of the standard three-phase type the regulator functions to maintain an average voltage on the three phases.

The control element is inclosed in a glass case supported by an insulating base 10 in. wide by 14 in. high. The unit extends 8½ in. out from the front of the panel on which the regulator is mounted. On the base two voltage adjusting rheostats similar to those used in radio work are supported, which do the adjusting. Their small size permits their location on the control element itself rather than on the switchboard panel, as has been the usual practice. The regulator control element itself, exclusive of the power circuit feeding it, weighs approximately 37 lb.

•

Welding Helmets Improved

Welding helmets identified as No. 650 and particularly suited for work in confined spaces such as tanks, ships' hulls, locomotive front ends, fire boxes and similar places have been developed by the Safety Engineering Bureau of the American Optical Company, Southbridge, Mass. They are designed to fit closely to the face and sides of the head without sacrificing ventilation or causing light leaks and are cool and comfortable under the most humid conditions. The bakelite welding glass holder is outside of the helmet and fully dielectric to protect the wearer from accidental contact with the electrodes. The added distance from the face to the welding plate permits the helmet to be comfortably worn with a respirator and helps prevent fogging as well. "Noviweld" glass, which screens out more than 99½ per cent of all injurious light rays, is standard equipment.

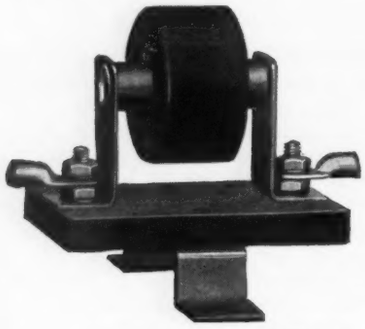
A swivel connection between helmet

and headgear provides three positive positions in which the helmet can be set when in use. Looseness, slipping and side play are eliminated. The entire unit is extremely light in weight and the balance between headgear and helmet increases the speed and positiveness with which the helmet can be set in position.

•

Thyrite Resistors Dissipate D.C. Surges

To protect the insulation of d.c. magnetic circuits against excessive discharge voltages when the circuits are opened type CR9196 discharge resistors have been introduced by the General Electric Company, Schenectady. The resistors act on the same principle as the "Thyrite" lightning arrester, acting practically as an insulator at line voltages, but conducting sixteen times



General Electric

more current each time the voltage is doubled. The continuous watts loss for this type unit is approximately 2 per cent of that for the equivalent permanently connected fixed resistors.

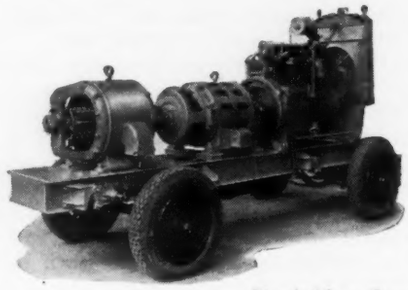
Units are available in two ratings—one for 110 to 275 volts, the other for 500 to 650 volts. The mounting dimensions and space requirements of both ratings are the same. They can be conveniently applied to protect d.c. motor fields, lifting magnets, shunt fields of a.c. and d.c. generators, etc.

•

Portable Power Plants for Dual Field Service

Portable power plants for wide application to supply either d.c. or a.c. have been introduced by the Harnischfeger Corporation, Milwaukee, with the delivery of the unit shown to a large Eastern utility. It is used as an emergency unit supplying power for interrupted service in outlying districts where power lines are not immediately available and for portable tools on construction work. The 50-kw. capacity engine-driven generator set furnishes either 230 volts d.c. or three-phase, 60-cycle a.c. Either supply or both are available for any job up to the capacity of the driving engine. The d.c. unit acts as the exciter for the a.c. unit.

Permitting the operation of any number of electrified drives without installation of expensive power lines, this unit has a wide range of usefulness, includ-



Harnischfeger Corp.

ing its application as a power unit for contractors, industrial emergency use or for a number of purposes around the large farm or ranch. As a trailer unit, it is practical for any kind of field service. It is also finding favor among crane operators where power is switched from d.c. to a.c. Such operators show considerable savings by installing a motor-generator to retain the superior d.c. control without the necessity or expense of changing over motors, brakes and controls to meet a.c. requirements.

•

Vertical Motoreducers

Similar in construction to its horizontal units, three types of Falk vertical "Motoreducers" in capacities from $\frac{3}{4}$ to 75 hp. have been announced by the Falk Corporation, Milwaukee. Types IX (illustrated) and ZX are for double or triple reduction in ratios from 9.7 to 288 and the type LX for single reduction only in ratios 1.5 to 9. All are for

The Falk Corp.

downward extension only. The type IX is an integral unit used with standard round-frame motors with one end-bell removed; the type ZX is for use with any standard horizontal ball bearing motor (with feet) unchanged, with resilient connection to the gearing, and the LX type is a geared head design, also utilizing round-frame motors. Ordinarily 1,750 r.p.m. motor speeds are considered standard, but other speeds may be used when specified. Bearings are ball or roller as required, gears are precision, single helical type of alloy steel; pressure lubrication is employed, with careful provision for proper oil pressures, pump speeds and oil seals. Details are given in Bulletin 271.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

THIS PROBLEM OF DIVERSION OF ELECTRICAL ENERGY, booklet of the Electrical Division, Department W, the Corcoran Brown Lamp Company, Cincinnati, Ohio, will be mailed to listed officials of public utility companies whose request is made on company stationery. Confidential booklet on current diversion compiled by a well-informed engineer based on the experience of public utility companies and Corcoran-Brown new-sequence service equipment.

THE IMPORTANCE OF PROPER SELECTION OF A PROTECTIVE WELDING LENS, leaflet of the Lincoln Electric Company, Cleveland, Ohio, 2 pages. Discussion of the radiant energy emitted by the welding arc, together with the Bureau of Standards certification of energy transmission of Lincoln super-visibility protective lens.

RECOMMENDED FOOT-CANDLES FOR INTERIOR AND OUTDOOR LIGHTING, folder of the Hygrade Sylvania Corporation, Salem, Mass. Gives the recommended and minimum light intensities for industrial and commercial interiors, outdoor lighting and streets and thoroughfares of a number of classes, together with a table of per cent light absorption by different colors.

DIRECTIONAL OVERCURRENT RELAYS, catalog Section 41-505 of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, 12 pages, March, 1934. The application, characteristics, distinctive features, illustrations, wiring and dimension diagrams and other engineering features of Westinghouse Types CR and CRA relays of this type.

TIME SWITCH FOR CONTROLLED WATER HEATING, leaflet GEA-1669B of the General Electric Company, Schnectady, 2 pages, May, 1934. Illustrated leaflet on the construction and application of G.E. automatic time switches, Type T-11, telechron-motor-operated.